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DETWILER (S. B.). **Black Currant spreads White-Pine blister rust.** —*U.S. Dept. of Agric. Misc. Publ.* 27, 8 pp., 4 figs., 1928.

The main scope of this publication is to popularize the view that the eradication from all the white-pine growing areas in North America of the European black currant (*Ribes nigrum*) is essential if adequate control of the white pine rust (*Cronartium ribicola*) is to be attained. This species of currant, which although not extensively cultivated is to be found to some extent in most districts where currants are grown, has been recognized by the United States Department of Agriculture as a distinct menace to the white-pine timber supply of the country, and recommendations have been issued that active steps should be taken for its prompt elimination from the Pacific, Rocky Mountain, Atlantic, Appalachian, Ohio Valley, upper Mississippi Valley, and Lake States. The Department advises against the growing of this currant anywhere in the United States, since it has been shown that black-currant bushes become infected with the rust in localities far from infection centres, causing the disease to spread by leaps and bounds. A case is cited where black-currant bushes were infected by spores that had been carried by the wind over a distance of at least 110 miles.

It has been conclusively demonstrated during the last 10 years that, under ordinary forest conditions in the eastern United States, white-pine plantations suffer no further appreciable loss from blister rust after all currant and gooseberry bushes are removed from the pine area and from a surrounding zone 900 feet wide, except that where black-currant bushes occur they must be eradicated within a radius of at least one mile from the pines, while occasionally it is also necessary to remove large plantations of the yellow and red flowering currants [*R. odoratum* and *R. sanguineum*] within the same radius. Further observations are still required in order to determine the exact width of the protective zone in the western United States, but it is not believed that it will vary greatly from the distances found effective for local control of blister rust in the eastern States.

HAGEM (O.). **Lophodermium-Schütte in West-Norwe .** [*Lophodermium* leaf fall in western Norway.]—*Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz*, xxxviii, 7–8, pp. 193–208, 1928.

This is a condensed account of the writer's investigation in western Norway on leaf fall of Scotch pines (*Pinus sylvestris*) caused by *Lophodermium pinastri*, a fuller paper on which has already been noticed [*R.A.M.*, vi, p. 452].

ENGELBRECHT (M.). **Soll man gegen die Kiefernschütte spritzen?** [Should spraying be carried out against leaf fall of Pines?]—*Illus. Landw. Zeit.*, xlviii, 26, p. 341, 1928.

Leaf fall of pines (*Lophodermium pinastri*) is stated to have assumed an epidemic character on 7- to 10-year-old trees in north-east Germany during recent years [cf. *R.A.M.*, vi, p. 705]. The ascospores are carried for considerable distances by the wind, but the more serious contact infection is restricted to a radius of 3 m. The mycelium of *L. pinastri* is extraordinarily tenacious, persisting in diseased needles for years until suitable conditions favour its development. The apothecia mature in immense numbers from the end of June onwards, and infection occurs chiefly during the period between mid-July and early September.

Good results in the control of leaf fall have been obtained by judicious and timely applications of copper-containing preparations [ibid., vii, p. 551], the first being given in the middle of July and the second a month later. On account of the difficulty of preparing Bordeaux mixture, ready-made copper fungicides, e. g., Heufeld Burgundy mixture [ibid., v, p. 709], are stated to be in considerable demand. The average cost of 250 l. of this preparation (sufficient to spray 1 hect.) is M. 4, while Hartwig's Schüttesalz and Bordola paste [loc. cit.] are slightly dearer. Generally speaking, experience has shown that the spraying of pines against *L. pinastri* is much cheaper than the rehabilitation of neglected stands. The longevity of the mycelium necessitates the destruction by burying or burning of all dead plants and needles. Dense planting should be avoided on account of the risks of contact infection, and fresh sites should not be established in the vicinity of pine stands, but should, if possible, be located in the midst of deciduous trees.

FALCK (R.). **Lärchensterben und Theorie der Krebsbildung. T. 1. Lärchensterben und Stammkrebsbildung.** [Die-back of Larches and theory of canker formation. Part 1. Die-back of Larches and stem canker formation.]—*Gartenbauwissensch.*, i, 1, p. 53, 1928. [Abs. in *Fortschr. der Landw.*, iii, 18, p. 860, 1928.]

Larches have been cultivated in Prussia since 1750, and only since 1850 have cases of die-back been reported, though they subsequently occurred with increasing frequency. From 1900 onwards the general symptoms of die-back, culminating in an attack on the crown, have been overshadowed by the occurrence of stem cankers due to *Dasyscypha willkommii* [*R.A.M.*, vii, p. 483]. A parallel is drawn between the die-back of firs [in the Rhine Province: ibid.,

spores, gametes, zygotes, cysts, mature amoebulae, preplasmodia, and buds, but under favourable conditions some of these may be omitted. In culture the organism may be induced to emerge from the encysted condition by the addition of pieces of turnip. Endogenous buds may be developed by the pinching off of a portion of a nucleus, followed by mitosis of the separated nucleus. The amoebulae are occupied by a contractile vacuole near the nucleus. Certain inclusions resembling the parasite *Calkinsi* [*R.A.M.*, vii, p. 810] occur in the endosarc of the amoeboid and preplasmodial stages, and it is thought that they may facilitate the entrance of the plasmodium into the host and its passage from one cell to another.

Cultures of *P. brassicae* from cabbage galls were used for inoculation of turnip with positive results, the organism being reisolated. The uninucleate amoebae enter the turnip at the base of a young root, entrance being effected through the parenchyma at the point where the root emerges, and they then work their way towards the growing region.

BLUNCK (H.). **Versuch zur vergleichenden Prüfung chemischer Mittel gegen Kohlhernie.** [Attempt at the comparative evaluation of chemical preparations against club-root of Cabbage.]—*Gartenbauwissensch.*, i, 2, pp. 154–176, 3 figs., 1 diag., 2 graphs, 1928.

Full details are given of an experiment in the control of club-root of cabbage (*Plasmodiophora brassicae*) conducted during 1926–7 on heavily infested sandy soil at Horneburg on the Lower Elbe. The following substances were tested: caustic lime (1 or 2 kg. per sq. m.); formaldehyde 0·04 per cent. (four applications at the rate of 4 l. per sq. m. in 1926) and 1 per cent. (5 l. per sq. m.) in 1927; uspulun dust (2·5 gm. per plant hole), followed by watering with 0·25 per cent. uspulun before or after planting the cabbage seedlings in 1926; in 1927, uspulun was applied both in the form of a 0·25 per cent. solution, and as a paste composed of 1 kg. loam, and 1 l. 0·25 per cent. uspulun [cf. *R.A.M.*, vi, p. 454]; Elhardt's wurzelschutz (Chem. Fabrik A. Elhardt Söhne, Kempten, Bavaria), applied as directed; bodenhelfer (Chem. Fabrik Flörsheim, Dr. H. Nordlinger), a carbolineum preparation stated to be identical with florium (1 l. per sq. m. of the 5 per cent. solution); and höchst [tillantin] dust (100 gm. per sq. m. in 1926 and 150 gm. per sq. m. in 1927).

The results of the experiments [which are tabulated and discussed] show that uspulun was the only proprietary preparation that consistently reduced the disease to a minimum [ibid., vii, p. 757]. Good results were also given by the stronger concentration of formaldehyde in 1927. The cost of these treatments per sq. m. was as follows: uspulun M. 0·42 in 1926 and 0·0547 in 1927; formaldehyde M. 0·024 in 1926 and 0·1875 in 1927. Excellent control of the disease was further given by caustic lime, especially at the higher rate. The yields of the plots receiving this treatment were approximately double those of the controls. Taking everything into account, this method was the most satisfactory of those tested. The cost of the lime applications was M. 0·0246 and M. 0·0492 for the low and high doses, respectively.

It was observed that the cabbage in plots following beans was less heavily infected than that succeeding cabbage.

NEUER (H.). **Beizversuche zu Erbsen.** [Steeping experiments with Peas.]—*Illus. Landw. Zeit.*, xlviii, 30, pp. 382-383, 4 figs., 1928.

Excellent results in the control of *Fusarium* sp. on five varieties of peas have recently been obtained by dusting the seed with tillantin R. The germination of, and yield from, the treated seed were much better than in the controls.

KALASHNIKOFF (K. J.). Появление парши на Сахарной Свекле. [Outbreak of scab on Sugar Beet.]—*La Défense des Plantes*, Leningrad, v, 2, pp. 271–272, 1928.

A brief account is given of an outbreak of scab [scurf] of sugar beet which occurred in 1927 in the experimental plots of the Myco-Entomological Station of the Government of Kursk [south-west Russia]. The affected roots bore on their surface numerous reddish-brown spots, chiefly arranged in a ring beginning at soil level and extending down for 0·5 to 2 cm.; at deeper levels their number and size decreased considerably. Most of the spots were from 6 to 7 mm. in diameter and irregularly rounded, but occasionally they developed shallow cracks at their margins and then became stellate. Their surface was depressed, usually by about 0·5 mm., rarely to a depth of 2 mm., and occasionally the central portion formed a slight bulge. The spots resulted in the development of a thick suberized layer in the underlying tissues, but did not penetrate deeply into the roots. Isolations from the affected portions yielded *Bacterium scabiegena* Faber [*Arb. Kais. Biol. Anst.*, v, p. 342, 1907], which is considered to be the causal organism. It is pointed out that beets raised from the same lot of seeds and grown in other areas of the Station remained entirely healthy, so that the affection was apparently present in the soil of the experimental plots.

MOURAVIEFF (V. P.). Мучнистая роса на Сахарной Свекле. [Powdery mildew of Sugar Beet.]—*Morbi Plantarum*, Leningrad, xvi, 3-4, pp. 175–178, 1927. [Received August, 1928.]

In giving a brief description of sporadic outbreaks of powdery mildew of the sugar beet (*Erysiphe communis* [*polygoni*] f. *betae*) which have been recorded since 1924 in the sugar-beet-growing areas of the Ukraine [*R.A.M.*, iv, p. 391], the author emphasizes the dangerous potentialities of this fungus, in view of the great facility with which the mildews are known to spread and the difficulty of controlling them. So far, the outbreaks have been strictly localized, but the intensity of attack in each case (all the leaves of the diseased beets were entirely covered by the mildew), and the fact that in each consecutive year new localities were infected, indicate that the disease is in the stage of intensification and spread.

Examination of diseased material from various localities showed that in every case the causal organism was the same. The mycelium was well developed on both sides of the leaves, chiefly along the main and secondary veins. Conidia were comparatively scarce; they measured 33 to 36 by 10 to 15 μ. The perithecia were numer-

ous, not clustered, 89 to 112 by 75 to 82 μ in diameter, with numerous (up to 40) appendages, somewhat exceeding the diameter of the perithecia in length, and with their lower half of a darker colour than the rest. The asci were lemon-shaped, with a distinct pedicel, and measured 55 to 66 by 31 to 40 μ; they usually contained four ascospores measuring 16 by 10 μ.

No recommendations are made for the control of the disease.

MOURAVIEFF (V. P.). Влияние заражения клубочков Сахарной Свеклы сферопсидальными грибками на развитие корнееда. [Influence of the infection of Sugar Beet seed-clusters with Sphaeropsidaceae on the development of root rot.]—*Сборник Сортоводно-семенн. Управл. Сахаротреста* [*Magazine of the Seed Selection Committee of the Sugar Trust*], *1927*, 1 (9), pp. 105–111, 1 graph, 1927. [Received July, 1928.]

The experiments briefly described in this paper were undertaken at the Mironovka [Ukraine] Experimental Seed Selection Station with a view to elucidate the bearing of the presence on the seed-clusters of sugar beet of pycnidia of species of Sphaeropsidaceae, chiefly *Phoma betae* [*R.A.M.*, vi, p. 649; vii, p. 419], on the development of root rot in the seedlings. The tests were made with seed naturally contaminated to the extent of 0 to 56 per cent., while seed disinfected by steeping for 20 hours in 2 per cent. copper sulphate was used as a control. The tests only covered one season and were not extensive; but they indicated that infection of the seed-clusters with these fungi does contribute to some extent to the appearance of root rot in the seed-beds, and that the percentage of diseased seedlings increased with the percentage of infection of the seed. The fact, however, that disinfection of the contaminated seed only slightly reduced the incidence of the disease would indicate that seed-borne fungi only play a secondary part in its development, good soil conditions and proper methods of preparing the beds being much more important in preventing its appearance. Seeds with a high percentage of infection should always be sown in specially chosen soil. Infection of less than 10 per cent. appears to be of no practical significance.

GUYOT (A. L.). **Sur la désinfection des graines de Betterave.** [On the disinfection of Beet seed.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 4–5, pp. 124–133, 1928.

Brief, popular notes are given on the heart rot and blackleg diseases of beets caused by *Phoma betae* [*R.A.M.*, vi, pp. 529, 648], and on associated conditions due to various soil fungi, disinfection of the clusters [see following abstract] as a means of control being discussed with reference to recent work on the subject, most of which has already been noticed from other sources.

DE LANYE (OLGA) & GUYOT (A. L.). **Sur la désinfection des graines de Betterave.** [On the disinfection of Beet seed.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 6, pp. 160–172, 2 figs., 1928.

Experiments were conducted to ascertain the effect upon the germinative power (i.e., the number of seeds obtained from 100

seed-clusters placed on the surface of sand or earth in dishes) and germinative energy (similarly estimated, except that the clusters were covered with a layer of sand) of beets when the seed clusters were previously wetted with water or various chemical disinfectants [such as are likely to control *Phoma betae*: see preceding abstracts].

The results [which are tabulated] showed that water at 15° C. markedly reduced germinative power on sand but increased it on earth; this power was unaffected by water at 25°, but was seriously reduced on both sand and earth at 50°, while germinative energy was very adversely affected at all temperatures except in sand at 15°. Sulphuric acid was not harmful when the clusters were placed on or in sand but markedly diminished the germinative power and energy on or in earth. Cresols (in soap emulsion), and especially phenol, seriously reduced germinative power and energy, as also did formalin, which markedly reduced germination on sand. Bichloride of mercury lowered germination and also reduced the germinative energy by more than 30 per cent. Preparations with a basis of complex organic mercury salts (sodium cyanomercuricresolate, mercury chlorophenate, and a mercury copper arsenic preparation) were harmful to clusters on or in sand, but when soil was used they improved both the germinative power and energy, the latter by 30 per cent.

COSTA (T.). **Contributo allo studio della 'Cercospora beticola' (Sacc.) nella bassa vallata Padana.** [A contribution to the study of *Cercospora beticola* (Sacc.) in the lower valley of the Po.]—*Nuovo Giorn. Bot. Ital.*, xxxv, 1, pp. 25–27, 1928.

After recommending the application of a copper protector dust (powdered lime and copper in the form of 5 or 10 per cent. oxychloride or hydrocarbonate) [*R.A.M.*, vii, p. 526] to the growing crop for the control of leaf spot of beets (*Cercospora beticola*) [ibid., vii, pp. 694, 695], the author states in a foot-note that the conidia of the fungus germinate freely in a solution of 0·001 per cent. copper, but that germination decreases as this concentration is increased, until it is very slight and weak at 0·01 and ceases at 0·125 per cent. Under normal conditions the conidia of *C. beticola* germinated freely in water in two or three hours and readily infected both surfaces of leaves of all ages, producing visible symptoms in eight to ten days. This period is sufficient, during rapid growth, to permit the youngest leaves to reach almost their full size. Further, referring to the view that infection by *C. beticola* is favoured when periods of turgescence are followed by temporary wilting of the leaves, the author states that noticeable infection was observed even in beets kept continually turgid by watering, while others from the same seed that were not watered remained unaffected. Plants grown from early germinating seed are the first to be attacked. He considers that if the crop is maintained in a vigorous condition, no severe infection by *C. beticola* need be feared. Under local Italian conditions, the most marked infection occurs during the period when leaf production is at a standstill, perhaps owing to the hastening of maturation of the roots for commercial purposes.

Mori, Baroni, & Costa [T.]. **Esperimenti di lotta contro la Cercospora della Barbabietola in Italia.** [Experiments in the control of *Cercospora* of the Beet in Italy.]—*L'Indus. Saccarifera Ital.*, xxi, 7, pp. 311–319, 1928.

The authors, as delegates of a special technical committee for the study of Italian beet-growing problems, here report the results of an extensive series of experiments in the control of leaf spot (*Cercospora beticola*) [see preceding abstract] from 1922 to 1927 (excluding 1925).

The data obtained in these tests [which are presented in tabular form] clearly demonstrate the efficacy of spraying or dusting with copper compounds against this disease. Approximately comparable results were given by five or six applications of Bordeaux mixture or eight to ten of the dusts ('protector ramato' and Caffaro powder in varying concentrations), but the liquid treatment was slightly more economical (total cost L. 212 to 254 per hect., compared with L. 216 to 270 for the dusts).

No ill effects have been observed as a result of feeding cattle on treated beet tops.

St. **Eine drohende Gefahr für den einheimischen Zuckerrübenbau.** [A formidable danger to the home cultivation of Sugar Beets.]—*Mitt. Deutsch. Landw. Gesellsch.*, xliii, 1, p. 18, 1928.

Two diseases are stated to have been mainly responsible for the reduced yield and low sugar content of the German beet crops in 1927, viz., leaf spot (*Cercospora beticola*) [see preceding abstracts] and the so-called 'girth scab' [*Actinomyces* sp.: *R.A.M.*, v, p. 204; vii, p. 137]. An analysis of healthy and diseased samples of beets affected by those two conditions showed an average reduction of 1·3 per cent. in the sugar content in the case of leaf spot, and of 1·5 per cent. in that of girth scab. The first symptom of the latter disease (which is specially prevalent in Silesia and Poland) is the appearance of an irregular brown ring on the roots, followed by the destruction of the cells from the exterior inwards and the marked shrinkage of the severely discoloured beets. Both these diseases are considered to require further investigation.

The downy mildew of the Onion.—*Min. of Agric. Leaflet* 178 (rewritten June, 1928), 5 pp., 2 pl., 1928.

A popular description is given of the symptoms, distribution, and life-history of *Peronospora schleideni*, the causal organism of downy mildew of onions [*R.A.M.*, vii, p. 216], with directions for its control by cultural methods; the use of resistant varieties, e.g., Cranston's Excelsior, Rousham Park Hero, and Up-to-Date; and repeated applications of Bordeaux mixture or dusts composed of finely divided sulphur or of two parts sulphur to one part of powdered lime. It is stated that the hibernating mycelium in the sets can be destroyed by heating to 40° C. for eight hours, without injury to the bulbs, and trials of this promising method of control where set planting is practised are recommended.

FLACHS [K.]. **Die Septoria-Blattfleckenkrankheit des Selleries u. ihre Bekämpfung.** [The *Septoria* leaf spot disease of Celery and its control.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, vi, 4, pp. 93–96, 2 figs., 1928.

Leaf spot of celery (*Septoria apii*) is stated to be assuming serious dimensions in Bavaria [*R.A.M.*, vi, p. 332]. Brief, popular notes are given on the life-history of the fungus, which is stated to thrive at a temperature of 15° to 21° C. The spores in the dead leaves retain their viability only for 8 to 11 months, whereas in the seed they may live for one to two years [ibid., v, p, 402]. Good results have been obtained by seed treatment with uspulun and germisan, as well as by 24 hours' immersion in copper sulphate. In the United States the hot water treatment (ten minutes at 48°) has been successfully adopted. Seed-beds should be disinfected with 0·5 per cent. uspulun or germisan or 0·1 per cent. formalin, and the growing plants sprayed with Bordeaux mixture (1 per cent. for the first and 2 per cent. for later applications).

NICOLAS (G.) & AGGÉRY (Mlle). **La fonte des jeunes plants d'Aubergine.** [The damping-off of young Eggplants.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 6, pp. 149–151, 1928.

During April, 1928, the authors received from Toulouse young eggplants in which the base of the stalk was rotted and covered for several centimetres with the erumpent black pycnidia of *Ascochyta hortorum*.

The pycnidia were spherical, slightly flattened, and measured 270 to 370 by 170 to 235 μ; the hyaline, oblong, uni- or bicellular spores (the former of which often contained two oil drops, while the latter were slightly constricted at the septum) measured 6 to 11·75 by 2·8 to 4 μ.

No difference was detected by the authors between *A. lycopersici* [*Didymella lycopersici*: *R.A.M.*, i, pp. 149, 150] on diseased tomato stalks found near Toulouse and *A. hortorum*. They consider that the two are probably the same species, which should, by priority, be known as *A. hortorum*.

DECKENBACH (K. N.). Опыты применения известково-серного отвара и некоторых других веществ против мучнистой росы Ворсянки и тыквенных. [Experiments in the control of the powdery mildews of the Fuller's Teasel and of Cucurbitaceae by means of lime-sulphur and some other substances.]—*Morbi Plantarum*, Leningrad, xvi, 3–4, pp. 172–175, 1927. [Received August, 1928.]

Brief details are given of a series of experiments which were made in 1926 at the Plant Protection Station of the south coast of the Crimea to test the effect of some fungicides on the powdery mildews (*Erysiphe cichoracearum* and *Sphaerotheca* [*humuli* var.] *fuliginea*) of the Cucurbitaceae, including cucumbers, vegetable marrows, melon, watermelon, and loofah [*Luffa cylindrica*], and *S. macularis* on the fuller's teasel (*Dipsacus fullonum*). On the Cucurbitaceae the disease was entirely controlled by spraying the plants with a 1 in 50 solution of lime-sulphur or by dusting them with sulphur; these treatments did not cause any visible injury to

the foliage, while all the other substances tested, including sodium arsenate solutions alone or with the admixture of lime or of soda, and soda solutions by themselves, caused severe scorching. Weaker solutions (1 in 100 and 1 in 200) of lime-sulphur only gave partial control. On the fuller's teasel only the 1 in 50 solution of lime-sulphur was tested, and the treatment ensured full freedom of the plants from the disease.

CIFERRI (R.). **Osservazioni sulla specializzazione dell' 'Albugo Ipomoeae-panduratae' (Schw.) Sw.** [Observations on the specialization of *Albugo ipomoeae-panduratae* (Schw.) Sw.]—*Nuov. Giorn. Bot. Ital.*, xxxv, 1, pp. 112–134, 1 pl., 2 graphs, 1928.

The author states that *Albugo ipomoeae-panduratae* (*Cystopus ipomoeae-panduratae*) is found in the Dominican Republic on the sweet potato (*Ipomoea batatas*), *I. pes-caprae* [*I. biloba*], *I. acuminata*, and *Rivea bracteata* [*I. bracteata*].

Cross-inoculation experiments [details of which are given] with conidia of the fungus taken from *I. batatas* gave 52 per cent. positive results on this host, but failed on the other hosts tested, while similar inoculations with conidia from *I. biloba* gave 34 per cent. positive results on its proper host, and failed on the others.

These indications of the existence of two strains of the fungus were confirmed by biometrical examination [details of which are given] of the conidia and oospores on these two hosts.

The author accordingly considers that two specialized forms or biological species should be established within the comprehensive species *C. ipomoeae-panduratae*, one of which he names *A.* [*C.*] *minor* (Speg.) Cif. n. comb. (*C. convolvulacearum* var. *minor* Speg.) on *I. batatas* and the other *A.* [*C.*] *ipomoeae pes-caprae* Cif. n. sp. on *I. biloba* on which it causes deformities on all the above-ground parts of the plant. A Latin diagnosis of each of these is given, and there is a bibliography of 25 titles.

LOBIK (A. I.). **Болезни Виноградной лозы, вызываемые паразитными грибками.** [Vine diseases caused by parasitic fungi.]—*Изв. Терской Окружной Станции Защ. Растений* [*Terek Regional Plant Prot. Stat. News*], i, 2, pp. 1–34 and 58, 1 pl., 1926. [French summary on pp. 67–68. Received August, 1928.]

This is a semi-popular account of the fungal diseases of the vine that occur in the Terek province [north Caucasus], including brief descriptions of the chief parasitic and saprophytic fungi which have been so far recorded on this host in the province. The most important are stated to be mildew (*Plasmopara viticola*) and the leaf spots caused by *Cercospora vitis* and *C. roesleri* [*R.A.M.*, vii, p. 617], which in certain years break out epidemically over the whole province and cause very appreciable losses to the crop. The other parasitic fungi listed occur only occasionally and include *Phyllosticta succedanea* [ibid., vi, p. 207]; *P. viticola*; *P. vitis*; *Ascochyta ampelina*; *Diplodia viticola* f. *foliicola* nov. f., which forms on the leaves irregular spots with a narrow purplish-brown margin, bearing large black, immersed pycnidia, 130 to 148 μ in diameter, con-

taining long-ovoid, bicellular spores with broadly rounded ends, straight or slightly curved, faintly constricted at the septum, and 19·7 to 24·7 by 10 to 11·5 μ in diameter; *Camarosporium cookeanum*; *Hendersonia vitiphylla* var. *maior* nov. f., causing on the leaves brown spots up to 5 mm. in diameter with a thin, dark purple margin, on the upper surface of which are flat, dispersed pycnidia, 130 to 230 by 98 to 130 μ in diameter, containing greenish-brown, obovate, 3-septate spores, 13 to 14·8 by 5·5 to 6·6 μ in diameter, with one end broadly rounded and the other elongated; a species of *Heterosporium*; *Oidium tuckeri* [*Uncinula necator*]; *Coniothyrium diplodiella*; and *Gloeosporium ampelophagum*.

CAPUS. **Sur la teneur en cuivre des bouillies contre le mildiou de la Vigne.** [On the copper content of mixtures for the control of Vine mildew.]—*Comptes rendus Acad. d'Agric. de France*, xiv, 25, pp. 854–857, 1928.

The results of experiments carried out in 1927 at various branches of the French Agricultural Research Institute have confirmed the data obtained in previous investigations [which are summarized] concerning the superiority, for the control of downy mildew of the vine [*Plasmopara viticola*], of Bordeaux mixtures containing 1 to 3 per cent. copper sulphate over those with a lower copper content [*R.A.M.*, vii, p. 220]. The use of a mixture containing 2 per cent. copper sulphate is recommended for wet and cold seasons, and in general for susceptible varieties growing in damp soils. In exceptionally humid seasons vines which have already been attacked should be given a final application of 3 per cent. Bordeaux mixture. The employment of mixtures containing only 1 per cent. copper sulphate should be restricted to resistant varieties in dry and warm situations.

RAVAZ (L.). **Brûlures par les bouillies.** [Scorching caused by mixtures.]—*Prog. Agric. et Vitic.*, xlv, 23, p. 545, 1928.

During 1928 much scorching was caused in French vineyards by applications of excessively acid or alkaline Bordeaux and Burgundy mixtures. The former type of burn causes small, sharply defined spots resembling the symptoms of anthracnose, while an excessively alkaline mixture causes larger burns which cause the leaf edges to turn down.

GUSSEVA (Mlle L. N.). Опыты сухого опыления Винограда против мильдиу. [Experiments in the control of Vine mildew by means of dusts.]—*Изв. Терской Окружной Станции Защ. Растений* [*Terek Regional Plant Prot. Stat. News*], ii, 1–2 (5–6), pp. 91–98, 1927. [French summary on pp. 135–136. Received August, 1928.]

The experiments briefly outlined in this paper were started in 1925 with a view to ascertaining the possibility of controlling vine mildew [*Plasmopara viticola*] by dusting the vines with a mixture of dehydrated copper sulphate and slaked lime, since spraying the vines with Bordeaux mixture presents practical difficulties in the north Caucasus. The results obtained in 1925 and 1926 showed that all the dusts used, particularly that consisting of

two parts lime to one part dehydrated copper sulphate, were as efficient as Bordeaux mixture in controlling the disease, when applied after a light rain or in the early morning while the leaves were still moist from dew. The dusts penetrated well to all portions of the vine stocks and adhered satisfactorily to both surfaces of the leaves and to the grape bunches. No scorching or other injurious effect followed their application. The dusting necessitated a somewhat higher expenditure of lime and copper sulphate than spraying, but it is believed that by adequately regulating the dusters the expense may be considerably reduced. The dry dusts may be kept for a long time without any noticeable alteration of their chemical or fungicidal properties.

CAMBONIE (L.). **Les soufres cupriques mouillables.** [Wettable cupric sulphur.]—*La Vie Agric. et Rurale*, xxxii, 23, pp. 367–368, 1928.

The writer cites some cases in which excellent control of downy mildew of the vine [*Plasmopara viticola*] with wettable cupric sulphur dusts containing 1·5 per cent. metallic copper [*R.A.M.*, vii, p. 697] has been secured. This treatment is also efficacious against *Oidium* [*Uncinula necator*].

RAVAZ (L.). **Chronique: Le rot blanc.** [Current events: white rot.]—*Prog. Agric. et Vitic.*, xc, 27, pp. 3–4, 1 col. pl., 1928.

In this article, which is illustrated by a useful coloured plate, the author briefly describes the symptoms and manner of infection of white rot of grapes (*Coniothyrium diplodiella*) [*R.A.M.*, vi, p. 76; vii, p. 138] and states that partial control may be obtained if the bunches are sprayed or dusted with copper mixtures as soon as possible after hail has fallen.

RAVAZ (L.). **Recherches sur le court-noué.** [Researches on court noué.]—*Prog. Agric. et Vitic.*, xc, 27, pp. 5–11; 29, pp. 53–63, 1928.

In this paper the author summarizes fully the results of his investigations (conducted in collaboration with Soursac and Verge) into court noué of the vine [*R.A.M.*, iii, pp. 500 et seq.; vii, p. 425].

The disease [the symptoms and possible causal agencies of which are noted and discussed] is stated to occur in all countries where vine growing has been long established, and especially in the Mediterranean basin, though it is less prevalent farther north. It is found on all types of soil, but especially on those which tend to be waterlogged. It is commonest and most intense during cold, wet springs, but the vegetation of affected vines tends to resume normal growth in July. It reappears each spring on the same stocks, so that recovery does not seem to occur, though the disease is not usually fatal. It is transmissible by cutting and grafting and is also contagious, passing from the stock to the scion, and vice versa. It passes somewhat rapidly from an affected to a healthy plant if the two are in very close proximity (as when planted in a pot), but more slowly, if at all, when they are farther apart; as spread is very slow the disease often appears localized in small areas of a vineyard.

Isolated stocks in vineyards also become affected sporadically, and should be promptly removed.

Riparia, Jacquez (a hybrid of Vinifera and Aestivalis), 199^{16} hybrid of Riparia and Aestivalis, Riparia-Berlandieri, Vinifera-Berlandieri, and 333 E.M. are comparatively resistant, but all varieties of the *Vitis rupestris* group and hybrids of these are considered susceptible as are also the *V. vinifera* varieties. Amongst the latter, however, Syrah, Grand Noir, white and grey Terrets, white Ugni, and Mourvèdre are only moderately affected, while Aramon, Grenache, Cinsaut, and Caugnan are highly susceptible.

Numerous soil sterilization experiments [the results of which are tabulated] indicated that the cause of the condition exists either in the soil itself or on the roots or rootlets, though since the disease is transmissible by cutting and grafting the causal agency would also appear to exist in the aerial parts of the vine. Very good results were obtained from treatment of the soil with lime. The authors recommend, provisionally, that when replanting is to be effected the ground should be thoroughly dug over in July and August, to benefit by the sterilizing effect of the sun, and that lime should be mixed with the freshly turned soil at the rate of 5 tonnes per hect. [nearly 2 tons per acre] or more, the same quantity again being used just before planting. In subsequent years a smaller amount of lime should be used before or immediately after the harvest, or even in spring.

Bericht der Lehr- und Forschungsanstalt für Wein-, Obst- und Gartenbau zu Geisenheim a. Rh. für das Rechnungsjahr 1927. [Report of the Viticultural, Pomicultural, and Horticultural College and Research Institute at Geisenheim a. Rh. for the financial year 1927.]—*Landw. Jahrb.*, lxviii, Supplement 1, pp. 415–506, 1928.

This report, prepared on similar lines to those of previous years [*R.A.M.*, vii, p. 10], contains the following items of phytopathological interest in addition to those already noticed from other sources. The perithecial stage of *Microsphaera quercina* was again observed on purple oaks [*Quercus robur* var. *purpurea*] in the park belonging to the Institute, though not to the same extent as in 1926.

The following preparations gave satisfactory control of *Peronospora* of the vine [*Plasmopara viticola*]: nosperit A and B, Sch. Nr. 788 (liquid) and the undermentioned dusts: nosperit A and B, nosprasit [ibid., vii, pp. 697, 698], a copper dust supplied by C. F. Spiess & Sohn, Klein-Karlbach (Pfalz), a copper arsenic dust from the same firm, cusisa, cusarsen (Merck, Darmstadt), and petebe (Dr. Jakob, Kreuznach) [ibid., vii, p. 556].

The so-called 'mauke' disease of the vine [*Bacterium tumefaciens*] was ascertained to be most prevalent in the vineyards of the Saar and of the side valleys of the Rhine. Promising results in the control of the disease were given by the excision of the tumours, followed by the application to the wounds of various disinfectant preparations, e.g., copper sulphate (30 per cent.), carbolineum, or dendrin.

Jahresbericht der Preussischen Landwirtschaftlichen Versuchs- und Forschungsanstalten in Landsberg a. d. Warthe. Jahrgang 1927–28. [Annual Report of the Prussian Agricultural Experimental and Research Institutes at Landsberg a. d. Warthe. Year 1927–28.]—*Landw. Jahrb.*, lxviii, Supplement 1, pp. 7–149, 8 figs., 2 graphs, 1928.

This report, prepared on the usual lines [*R.A.M.*, vii, p. 9], contains the following items of phytopathological interest. In a series of tests in the control of wheat bunt [*Tilletia tritici* and *T. levis*], *Fusarium* of rye [*Calonectria graminicola*], and stripe disease of barley [*Helminthosporium gramineum*] with a number of commercial fungicides, the best results were given by tutan, abavit B, and tillantin dusts. The total cost (including labour and machinery) of treating 10 cwt. by seed-grain with these preparations is estimated as follows: tutan 0·3 per cent. (for wheat, rye, and barley) M. 10·45; 0·5 per cent. (for oats) M. 15·95; abavit B 0·3 per cent. M. 10·10; 0·5 per cent. M. 15·30; and tillantin 0·3 per cent. M. 9·85; 0·4 per cent. M. 12·40.

An infallible diagnostic character of mosaic disease of potatoes is stated to be the more or less complete absence of 'kristallsand' cells [cells containing monoclinic calcium oxalate crystals, characteristic of Rubiaceae and Solanaceae] in the discoloured tissues. On the other hand, yellowish-green variegated leaves and those affected by aucuba mosaic show a uniform distribution of crystal sand cells over the entire area.

The following potato varieties are stated to be immune from wart disease [*Synchytrium endobioticum*]: Ebstorfer Juliperle, Frühe Flocken, Frühe Königin, Goldappel, Görsdorfer Nieren and Primrose, Kuckuck, Magdeburger Blaue, Rosafolia, Johannsen, Ackersegen, Erdgold, Max Delbrück, Parnassia, Paul Wagner, Preussen, Roland I, Sickingen, Tann, Wekaragis, and Cellini. All these were further resistant to mosaic, leaf roll, and blackleg [*Bacillus atrosepticus*]. Goldappel was fairly severely attacked by scab [*Actinomyces scabies*] and *Phytophthora infestans*. The reaction of these and a number of other varieties to the abovementioned diseases and *Rhizoctonia* [*Corticium solani*] is shown in tabular form.

None of the sugar and fodder beets tested showed any appreciable degree of resistance to root rot [*Phoma betae*, *Pythium de Baryanum*, and *Aphanomyces levis*] except Strube's 'Z' (3·8 per cent. infection compared with 15·25 in Knoche's 'Z'). Dusting the seed-clusters with uspulun-universal or immersion in H_2SO_4 failed to give adequate control.

VOGLINO (P.). **Il Laboratorio Sperimentale e il R.° Osservatorio di Fitopatologia di Torino. A ricordo del xxv anno di fondazione (1903–04—1927–28).** [The Experimental Laboratory and Royal Phytopathological Observatory of Turin. In commemoration of 25 years' establishment (1903–4 to 1927–8).]—46 pp., 4 pl., Torino, Tip. Palatina di Giuseppe Bonis, 1928.

The author reviews in brief detail the yearly activities of the Experimental Laboratory and Royal Phytopathological Observatory of Turin, from its establishment in 1903 until 1928, special atten-

tion being paid to the work done upon the identification of fungous and insect parasites of plants, the elaboration of control measures, and the breeding of resistant varieties. A section is devoted to the researches carried out during the period under review on fungous parasites, the present scope of the Institute's work is outlined, and there is a bibliography of publications by members of the staff.

PROSHKINA-KOBEZSKAYA (Mme A. I.). Болезни культурных растении на Украйне в **1926–1927** г.г. [Diseases of cultivated plants in the Ukraine 1926–1927.]—*Protection of Plants in Ukraine 1927–1928*, 3–4, pp. 25–32. [Received November, 1928.]

Brief notes are given on the incidence and severity in 1926 and 1927 of the most important bacterial and fungal diseases of field and truck crops in the Ukraine, arranged by the systematic position of the parasites, among which the following are of interest. Crown gall [*Bacterium tumefaciens*] was very widespread on apple and pear, and in some localities on cherry (in one case up to 100 per cent. of the trees were affected) and raspberry. In the district of Kharkoff eggplants suffered from attacks of an undetermined species of *Phytophthora*, and it was noticeable that in the neighbouring fields potatoes were severely affected by *P. infestans*, while in other districts the latter disease was slight. Vine mildew (*Plasmopara viticola*) was very prevalent in both years over the whole of the Ukraine; in some localities, particularly in 1926, it reduced the crop by over 50 per cent. Opium poppy and lucerne were heavily damaged by *Peronospora arborescens* [*R.A.M.*, vii, p. 536] and *P. trifoliorum*, respectively. In some districts gooseberry crops were entirely destroyed by American mildew (*Sphaerotheca mors-uvae*). In 1926 *Capnodium salicinum* was very prevalent on hops in districts which suffered from epidemic outbreaks of the hop aphid, *Phorodon humuli*. Wheat crops in 1927 suffered severely from bunt (*Tilletia tritici*), which in certain districts affected 45 to 50 per cent. of the plants; spring wheats, however, appeared to suffer less than the autumn sown.

Other diseases, of minor importance, include *Phyllosticta briardi* on apple; *P. tabaci* on tobacco; *Phoma ruborum* on raspberry; *Ascochyta melonis* on melon; *Septoria ampelina* on vine, particularly severe on the American varieties; and *Cercospora concors* on potato.

VEREȘCEAGHIN [VERESCIAGHIN] (B.). **Dușmanii plantelor de cultură din Basarabia în 1926.** [Enemies of cultivated plants in Bessarabia in 1926.]—*Viața Agric.*, *1927*, 13–14, pp. 343–349, 1927. [Received September, 1928.]

Brief notes are given on the incidence and severity in 1926 of the principal pests and diseases of cultivated plants in Bessarabia, recorded by the Bio-Entomological Station of Chișinau [Kishineff], among which the following are of interest. Apples suffered very severely from attacks of *Sphaeropsis malorum* [*Physalospora cydoniae*], *Phyllosticta briardi*, and *Venturia inaequalis*, and pears from *V. pirina* and *Mycosphaerella sentina*. In some nurseries

wild pear seedlings were heavily attacked by *Stigmatea mespili* [*Fabraea maculata*]. On plums the most prevalent diseases were those caused by *Polystigma rubrum*, *Phyllosticta prunicola*, and *Puccinia pruni-spinosae*. Peaches and almonds all over the country were rather damaged by *Clasterosporium amygdalarum* [*C. carpophilum*]. The principal disease of walnuts was *Gnomonia leptostyla*, which caused very appreciable losses to the crop. Among vegetable crops the greatest losses were caused by *Sphaerotheca humuli* on cucurbits, *Septoria lycopersici* on tomatoes, and *Cercospora beticola* on beets. The most prevalent cereal smuts were *Ustilago avenae* on oats, *U. hordei* on barley, and *U. maydis* on maize.

Reports on diseases of plants in Ceylon during 1927.—*Ceylon Dept. of Agric. Tech. Repts. for the year 1927*, pp. (1)–(11), 1928.

The following items, *inter alia*, are of interest in Dr. W. Small's Report of the Mycological Division. *Hevea* rubber was attacked by *Phytophthora* [? *meadii*: ibid., vi, p. 575] and *Colletotrichum* sp., both causing leaf fall, and by *Marasmius equicrinis* [ibid., v, p. 324] affecting the twigs. *Albizzia* seedlings were infected by sore shin due to *Corticium solani*. The stems of *Piper betle* were attacked by *C. solani* and *Phytophthora* sp. [ibid., vii, p. 303]. Preliminary experiments have shown that, while *Rhizoctonia bataticola* [*Macrophomina phaseoli*] may be induced to infect plantain [*Musa paradisiaca*] roots, and infected plants may subsequently develop bunchy top [ibid., vii, p. 62], the fungus cannot be held solely responsible for this condition.

SUNDARARAMAN (S.). **Administration Report of the Government Mycologist, Coimbatore, for 1926–27.**—*Rept. Dept. of Agric., Madras Presidency, for the official year 1926–27*, pp. 326–344, 1927. [Received October, 1928.]

The results [which are tabulated] of a series of tests on the varietal reaction of a number of rice strains to the blast fungus (*Piricularia oryzae*) showed a wide range of variation in their susceptibility [cf. *R.A.M.*, vii, p. 266]. Both at Coimbatore, where the disease was very severe, and at Aduturai the E.B. 24 variety showed a high degree of resistance, while Korangu Samba was very susceptible. In a series of manurial experiments it was found that applications of nitrogen (in the form of ammonium sulphate) up to 40 lb. per acre led to an increased yield of grain and chaff, whereas excessive doses (60 lb. per acre) caused a reduction due to the premature death of the ears from blast.

In an experiment conducted to determine the relative damage caused by soil- and seed-borne infections in the *Rhizoctonia* disease or wilt of groundnuts in the South Arcot district, the percentages of injury from these two sources were 37 and 40, respectively, indicating that they are equally important. Among the 20 varieties of groundnut tested for their reaction to this disease there was a wide diversity in the extent of infection.

The total number of Palmyra palms [*Borassus flabellifer*] eradicated for the control of bud rot [*Phytophthora palmivora*] in the

Godavari, Kistna, and Guntur districts during 1926 was 14,318 as compared with 19,721 in 1923. In spite of the gradual decline in the incidence of bud rot, the annual damage is still too heavy to permit the discontinuance of the special protective measures now in force [ibid., iii, p. 270].

During the past two years a severe outbreak of mulberry mildew [*Phyllactinia corylea*: ibid., vi, p. 519; vii, p. 304] was reduced by collar-pruning, destruction of diseased material, and spraying the ground with lime-sulphur; with the advent of the monsoon in May, however, there was a recurrence of the disease.

The examination of a number of betel vines [*Piper betle*] dying from an obscure root disease at Vellalore showed that the underground portion of the stem was in various stages of decay, while the roots were poorly developed. Two fungi, *Diplodia* sp. and *Gloeosporium* sp., were isolated from the decaying stems.

Considerable damage was caused in the Wynaad pepper [*P. nigrum*] gardens by a wilt disease associated with the occurrence of *Nectria* sp. in the stems and roots. The leaves dry up, turn yellow, and fall, the base of the stem is blackened, and eventually the wood splits along the medullary rays. Inoculation experiments with cultures of the fungus on *P. betle* at Coimbatore gave positive results.

Cultural studies of the fungus formerly known in India as *Rhizoctonia destruens* [ibid., iii, p. 78], isolated from zinnia, confirmed its identity with *Sclerotium rolfsii*.

Pythium aphanidermatum, isolated from *Opuntia dillenii*, readily infected the stems of cucumber, *Trichosanthes*, *Datura*, *Solanum*, and *Physalis*, and the leaves of *Amorphophallus* and *Basella* [ibid., vii, p. 488].

A new *Vermicularia* disease of cotton was studied on the Uppam and H. 25 varieties—the only ones affected. The fungus first appeared on the seedlings, causing spots on the cotyledons and, in some cases, a condition resembling sore shin of the stems [ibid., v, p. 19]. About 20 per cent. of the seedlings were killed by the disease in one field. A mild attack occurred later on the bolls. Seedlings of the above-mentioned varieties, sown in pots containing soil infected by the *Vermicularia*, contracted the disease and died, while the Karunganni and Cambodia varieties remained healthy under identical conditions.

Brooks (A. J.). **Annual Report of the Department of Agriculture, Colony of the Gambia, for the year ended March 31st, 1928,** 54 pp., 1 pl., 2 graphs, 1928.

In this report the results are given of further investigations conducted by the Agricultural Department of the Gambia into the rosette disease of groundnuts [*R.A.M.*, vii, p. 486]. The search for the hitherto undiscovered vector of the disease (*Aphis leguminosae*, the vector in South Africa, has hitherto not been found in the Gambia) has been continued, and two species of jassids belonging to the genus *Cicadulina* are suggested as possible agents.

Observations indicated that groundnuts, if not infected during the first eight weeks after sowing, remain unaffected. A scanty rainfall from the time of germination until the seedlings are about

one month old has a markedly intensifying influence on infection. The best time for sowing is during the drought which, under local conditions, occurs in June; the plants then have a better chance of developing too far to suffer much damage from the disease before the period when the vectors appear to be most active, i. e., mid-July to mid-August.

Generally, the attack begins in one plant near the outer edges of a farm, this serving as a centre of further infection. The nature of the spread strongly supports the view that the virus is insect-borne. Rapidly generalized infection of a type suggesting unusual activity of the vectors early in the growing season is contrasted with cases where the disease does not spread beyond a single plant or a small patch.

As a result of extensive observations and experiments it is considered to be fairly well established that infection is not carried in the seed or soil.

The control methods recommended consist in immediately destroying all germinating groundnuts from seed left in the ground from the previous season, in early sowing during the local drought, and in very thorough roguing during the growing period. The latter measure, however, may be very onerous, as can be judged by the fact that on one seed farm where infection existed over an area of about nine acres, 81 plants were rogued in the first week of September, 205 in the second, and 1,360 in the third.

Three definitely resistant varieties, namely, Basse, Philippine Pink, and Philippine White, have been raised, and are being grown in bulk for general distribution.

OGILVIE (L.). **Report of the Plant Pathologist for the year 1927.** —*Rept. Dept. of Agric., Bermuda, for the year 1927,* pp. 26–37, 1928.

Bananas in Bermuda are commonly attacked by a species of *Phyllosticta*, probably *P. musae-sapientii* [*R.A.M.*, vi, p. 580], which causes spotting and premature death of the older leaves.

A condition closely resembling mosaic was observed on bananas in Paget West during November, 1927. Linear streaks, usually measuring about 1 cm. by 1 mm. but frequently smaller, appear on the foliage. These streaks, which are often coalescent, are somewhat paler than the normal leaf colour and develop on a yellowish-green background. Affected plants are slightly dwarfed. Attempts to transmit the disease by the transfer of juice and by contact between normal and streaked leaves gave negative results. The aphid *Pentalonia nigronervosa* was present on the diseased plants [cf. ibid., vi, p. 173].

Carrots were generally infected by leaf spot (*Cercospora apii* [var.] *carotae*) in June.

A mosaic disease of *Hippeastrum* similar to that reported by Kunkel from Hawaii [ibid., iii, p. 598] has become increasingly prevalent in Bermuda of late years.

The lettuce disease previously considered to be identical with aster yellows [ibid., vi, p. 667] is now reported to be a serious form of mosaic, causing severe dwarfing, mottling, crinkling, and failure to 'heart'.

Two species of *Aspergillus* isolated from lily bulbs have been identified as near *A. melleus* and *A. luteo-niger*, respectively. These organisms are found only on bulbs suffering from unsuitable storage conditions and are incapable of infecting healthy scales. The spotting of lily bulbs known as 'black scale' was found to be due to asphyxiation in heavy or waterlogged soils, the *Volutella* sometimes associated with the condition being purely secondary [ibid., vi, p. 16]. The importation of all bulbs of the genus *Lilium* has been prohibited to prevent the introduction into Bermuda of soft rotting and other fungi.

Bacterium pruni was of common occurrence on peaches, causing a brown spotting and shot hole of the leaves.

The fungus responsible for the recent failures of the Bermuda pomegranate crop was found to be *Cercospora lythracearum* [ibid., vii, p. 186].

Macrophomina phaseoli [ibid., vii, p. 603] was found on Lima beans [*Phaseolus lunatus*] and lily roots.

EVELYN (S. H.). **Mycological work.**—*Ann. Rept. Dept. of Agric. Barbados for the year 1926–27*, p. 15, 1928.

A severe attack of cotton boll disease (*Bacterium malvacearum* var. *barbadense*) was reported.

Lignum vitae [*Guaiacum officinale*] suffered from wilt or stem canker associated with *Fusarium* sp.

Cephalosporium sacchari [*R.A.M.*, ii, p. 261] was responsible for the death of a few sugar-cane stools in one plantation.

[WALTERS (E. A.).] **Report on the Agricultural Department, St. Lucia, 1927.**—31 pp., 1928.

In the section of this report dealing with plant diseases (pp. 10–11) it is stated that the most important fungous disease noted during 1927 was wither-tip and blossom blight of limes (*Gloeosporium limetticolum*) [*R.A.M.*, vi, p. 479; vii, p. 226]. In the coastal estates, with a rainfall of about 70 inches or less, no wither-tip occurs in normal years and blossom blight is negligible. In wetter regions, chiefly in the Soufrière district, blossom blight reduced the crop to one-half or one-third of the normal. Where the annual rainfall averaged 95 inches, there was no formation of flowers owing to continuous wither-tip, and even the limes budded on sour orange [*Citrus bigaradia*] stock are continually attacked by blossom blight on young shoots that have succeeded in passing the wither-tip stage.

Pod rot of cacao [*Phytophthora palmivora* and *Botryodiplodia theobromae*] and *Rosellinia* root disease [*R. bunodes* and *R. pepo*: ibid., ii, p. 110] were prevalent, the latter being favoured by waterlogged soil.

Of 211,538 banana stools examined 26,365 were found to be diseased [chiefly with Panama disease due to *Fusarium cubense*] and were destroyed; the cultivation of this crop on a large scale has been practically abandoned.

Gumming disease of sugar-cane [*Bacterium vascularum*: ibid., vii, p. 226] occurs chiefly in the leaf form, no actual gumming being observed. The cane known locally as St. Kitts showed the leaf

striping in a pronounced degree, and it was also well marked where soil conditions were bad; in several such cases all the young shoots were striped and dwarfed, and the canes were poorly developed.

HASKELL (R. J.). **Diseases of cereal and forage crops in the United States in 1927.**—*Plant Disease Reporter, Supplement* 62, pp. 302–353, 1928.

This report has been prepared on the usual lines [*R.A.M.*, vii, p. 75], except that an attempt has been made to curtail it by quoting fewer collaborators' reports and reducing the number of references to literature. Only a few of the many interesting items can be mentioned. In a Connecticut wheat crop showing 10 per cent. bunt infection, *Tilletia tritici* was found only on one spike, all the rest being attacked by *T. levis*, which was also predominant in Michigan. In Utah the two fungi were found in about equal amounts in the 72 fields examined. In Washington *T. tritici* is still more prevalent than *T. levis*, but the latter has appeared in several of the drier localities in the wheat growing area [ibid., vii, p. 774].

The Leaf and Gold Coin varieties of wheat have shown great resistance to loose smut (*Ustilago tritici*) in Pennsylvania, while in Kansas the soft winter wheats, e. g., Harvest Queen, were much more susceptible than the hard red ones (10 per cent. infection compared with a trace).

Notes are given on the severe outbreak of stem rust of wheat (*Puccinia graminis*) in southern Minnesota and eastern North and South Dakota in 1927, and on the prevalence of leaf rust (*P. triticina*), which was more widely distributed and destructive than for several years past, especially in Pennsylvania, Iowa, and Nebraska. It is considered probable that the losses from leaf rust have hitherto been underestimated.

Glume blotch of wheat (*Septoria nodorum*) caused considerable damage (3 per cent. loss) in Maryland and was fairly severe also in Pennsylvania and North Carolina. In the last-named State the attacks on the nodes caused the collapse of a high percentage of the culms before the harvest.

Typhula graminum, with which *Sclerotium rhizodes* is considered to be identical [ibid., v, p. 745; vii, p. 28], was reported from Idaho on wheat in early spring where the snow remained late on the ground.

Stripe of sorghum (*Bacterium andropogoni*) [ibid., v, p. 723] was reported from Texas and Kansas, being very common in the latter State on Feterita, Kansas Orange, and hybrids of these varieties. An undetermined bacterial disease was found to be killing Milo varieties of sorghum at the Garden City Substation, Kansas. The diseased plants were dwarfed, badly discoloured (especially in the vascular system), and often rotted at the crown.

Alsike and hop clover [*Trifolium hybridum* and *T. procumbens*] in New York, and white clover [*T. repens*] in Utah, were attacked by leaf spot (*Cercospora zebrina*), which caused considerable damage. The Utah report is believed to be the first for that State.

McMillan (H. G.). **Diseases of vegetable and field crops (other than cereals) in the United States in 1927.**—*Plant Disease Reporter, Supplement* 61, pp. 223–300, 1928.

This report on the diseases of vegetable and field crops (including tobacco, cotton, and sugar-cane) in the United States in 1927 is prepared on the usual lines [*R.A.M.*, vii, p. 226]. On the whole, the data for 1927 are somewhat scanty as compared with previous years, but the paper contains a number of useful items of information, which are supplemented by references to recent literature in certain cases.

Thirty-eighth Annual Report of the Michigan Agricultural Experiment Station for the year ending June 30, 1926.—*Sixty-fifth Ann. Rept. Michigan State Board of Agric. from July 1, 1925, to June 30, 1926*, pp. 221–320, 20 figs., 1927. [Received October, 1928.]

The phytopathological section of this report (pp. 255–259), contributed by R. Nelson, contains the following references not already noticed from other sources. Progress has been made in the development of the Golden Self-blanching variety of celery, which is resistant to yellows [*Fusarium* sp.: *R.A.M.*, iv, p. 208]. This disease has recently spread to the two largest celery-growing districts of Michigan, viz., Decatur and Hudsonville.

The cytological examination of mosaic beans has again demonstrated the constant presence, in the chloroplasts of the subcortical cells of diseased stems and petioles, of certain very characteristic structures believed to represent a stage in the life-history of the causal organism.

The bacterial root rot of lucerne caused by *Aplanobacter insidiosum* [ibid., vii, p. 786] has been found in various parts of Cass County.

Continued resistance to bunt [*Tilletia levis*] has been manifested by the Berkeley Rock variety of wheat.

Good control of bacterial infection [*Bacterium gummisudans*: ibid., vi, p. 215] of gladiolus corms has been given by treatment with formaldehyde, which appears to be as effective as the more expensive organic mercury compounds. The penetration of the disinfectants was found to be facilitated by the addition of 20 per cent. alcohol to the solutions.

The transmission of yellows from chrysanthemum to aster [*Callistephus chinensis*] was effected by means of aphids.

Martin (W. H.). **Report of the Department of Plant Pathology.**—*Forty-eighth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1927*, pp. 205–238, 1 graph, 1928.

This report contains the usual observations on the distribution and prevalence of fungous diseases of plants in New Jersey during 1926–7 [cf. *R.A.M.*, vii, p. 306]. The following, *inter alia*, are of interest. Fruit spot (*Phoma pomi*) caused very heavy damage on Stayman, Golden Delicious, Grimes Golden, and Jonathan apples. In some orchards every apple was attacked and many rendered unsaleable. Gooseberry anthracnose (*Pseudopeziza ribis*) occurred with unusual severity.

Bacterial blight of beans (*Bacterium phaseoli*) caused exceptionally heavy losses, sometimes necessitating the ploughing under of the crop. Club-root of cabbage (*Plasmodiophora brassicae*) was completely controlled by adjusting the soil reaction to P_H 7·4 and above. Celery in cold frames was severely attacked by yellows (*Fusarium* sp.) [see preceding abstract]. Leaf spot of celery (*Cercospora apii*) was well controlled by the application of Bordeaux mixture, but copper-lime dust proved ineffectual.

Eggplants were again heavily damaged by wilt (*Verticillium albo-atrum*), the estimated reduction in yield for the State being 40 per cent. The Florida High Bush, New York Improved, and Black Beauty varieties are susceptible to this disease, the last-named particularly so. Fruit rot of eggplants (*Phomopsis vexans*) was unusually prevalent and caused much loss among the Long Purple, Florida High Bush, and Black Beauty varieties. Clean picking every seven days in an experimental plot of 400 plants reduced the number of rotted fruits to under 5 per cent. compared with 100 per cent. on an adjacent unpicked block.

Stem rot of potatoes (*Corticium vagum*) [*C. solani*] was very widespread and severe, especially in Central Jersey. The average reduction in yield for the State is placed at 3·5 per cent. The disease was most virulent in light soils where the seed-pieces were planted deep. Mosaic of potatoes caused a reduction in the yield of 3·2 per cent. for the State. In a test to determine the influence of the degeneration diseases on yield, the healthy plants showed 3·5 per cent. dead leaves on 27th July, while the corresponding figures for leaf roll, mild mosaic, rugose mosaic, and spindle tuber were 15, 55, 95, and 85 per cent., respectively. The yields on an acre basis were as follows: healthy 367, mild mosaic 291, rugose mosaic 135, spindle tuber 143, and leaf roll 94 bushels.

MILBRATH (D. G.). **Plant pathology.**—(*Eighth Rept. California Dept. of Agric. for the period ending December 31, 1927*). *Monthly Bull. Dept. of Agric. California*, xvi, 12, pp. 659–663, 1927. [Received September, 1928.]

A very destructive epidemic of powdery mildew (*Erysiphe cichoracearum*) occurred on cantaloupes in Imperial Valley during 1926 [*R.A.M.*, vi, p. 716], necessitating the adoption of emergency control measures in 1927. These were based on the results of investigations made in the previous year. Two applications of ground or sublimed sulphur were recommended, the first to be given when the paper covers were removed from the young plants (1 oz. of sulphur placed in a pile on the ground about 6 inches from the crown of each plant), and the second when the first seven or eight leaves unfurled on each runner (75 lb. of sulphur per acre strewn on the ground in rows about 1 foot from the crowns of the plants).

Late blight of tomato was more widespread and virulent than in 1926, affecting at least 5,000 acres of late plantings in four counties. The leaves, stems, and fruit were attacked, the last-named being infected through the sepals and peduncles. In some cases the symptoms of the disease were not manifested until seven days after picking, thereby creating an important pathological

problem in transit. The causal organism is thought to be probably a variant of *Phytophthora infestans* [cf. ibid., vi, p. 583].

The following cotton diseases were found to occur in the State: root rot (*Phymatotrichum omnivorum*), boll rots (*Alternaria* sp. and *Aspergillus niger*), sore shin (*Fusarium* spp.), and frosty mildew (*Ramularia areola*). Certificates were issued for consignments of cotton seed destined for Peru, vouching for the absence of anthracnose (*Glomerella gossypii*) and angular leaf spot (*Bacterium malvacearum*) in the districts of origin.

It is feared that the date palms (*Phoenix dactylifera*) which are grown on a commercial scale in California may become affected by bud rot, which has recently developed on *P. canariensis* at Los Angeles. Investigations are in progress to ascertain the cause and nature of this disease [cf. ibid., vi, p. 609].

Forty-sixth Annual Report of the Ohio Agricultural Experiment Station for 1926–27.—*Ohio Agric. Exper. Stat. Bull.* 417, 118 pp., 14 figs., 1 diag., 3 maps, 1928.

In the section of this report dealing with plant pathology (pp. 34–41) it is stated that satisfactory results in the control of oat smut [*Ustilago avenae* and *U. levis*] were obtained with two new dusts, one of which, made by absorbing 4 per cent. formaldehyde on an infusorial or charcoal powder ('filler'), gave less than 0·5 per cent. smut, and the other, made by absorbing iodine vapour on an infusorial-earth filler, gave complete control, as compared with 47 per cent. smut in the untreated plots. Both dusts were applied at the rate of 3 oz., at a cost of about 5 cents per bushel.

Grand Rapids disease of tomatoes [*Aplanobacter michiganense*: *R.A.M.*, vii, p. 362] caused heavy losses in Ohio greenhouses; the transmission of the organism through the seed was demonstrated, but tests of its ability to live in greenhouse soil for several months gave negative results. The disease is spread by the knives and fingers of the workmen. The virus of tomato streak [ibid., vii, pp. 481, 605] is stated to live for several months in the soil, if the latter does not dry out or become too warm. The disease was communicated to mosaic tomatoes by inoculations with the juice of potatoes affected with mild mosaic, rugose mosaic, leaf roll, spindle tuber, or of apparently healthy potatoes, and also with the juice of black nightshade [*Solanum nigrum*] and tomato when these had been previously inoculated with potato mosaic. Inoculations with juice from true potato seedlings gave negative results unless the seedlings were themselves previously inoculated with one of the potato virus diseases mentioned. Both *S. nigrum* and tobacco carried tomato streak, and the disease was also transmitted to eggplants.

Laboratory tests were conducted in which spores of the fungi causing apple scab [*Venturia inaequalis*], bitter rot [*Glomerella cingulata*], and brown rot of stone fruit [*Sclerotinia americana*] were placed with carefully determined quantities of various sulphur dusts and liquid combinations of lime-sulphur. The results [which are tabulated] showed that the sulphur lead dusts were better fungicides than pure sulphur, which in turn killed the

spores better than lime-sulphur mixtures, though the latter adhered best [cf. below, p. 45].

It is stated that an accumulation of iron (apparently as iron oxide) was found at the nodes of all maize plants examined, healthy or diseased, but no aluminium [ibid., v, p. 762]. It is concluded that this accumulation of iron neither causes nor results from root rot.

Twenty-seventh Annual Report of the Bureau of Agriculture, Philippine Islands, for the fiscal year ending December 31, 1927.—111 pp., 29 pl., 1928.

The following references of phytopathological interest, other than those already noticed from different sources, are contained in the section of this report dealing with plant diseases (pp. 56–80). The number of coco-nut palms found to be infected with bud rot [*Phytophthora palmivora*] in 13 provinces was 9,697, of which 8,064 were destroyed, while 8,250 palms were found attacked by the stem bleeding disease [*Thielaviopsis paradoxa*] and 4,356 were treated [*R.A.M.*, vii, p. 143].

The tentative conclusion that bunchy top and heart rot of abacá [*Musa textilis*] are different manifestations of the same virus disease is supported by successful inoculations by means of the aphid vector [*Pentalonia nigronervosa*: ibid., vi, p. 615]. Nematodes, the presence of excess aluminium salts, and various weak fungous parasites in the soil probably act as contributory factors. Susceptibility tests conducted in two of the heavily infected regions of Luzon indicate that a number of abacá varieties are partially resistant to the disease, while canton and pacol, two related but inferior fibre plants of the genus *Musa*, are immune. Fertilizing with calcium phosphate or potassium sulphate was found to increase the resistance of the semi-susceptible varieties, while certain complete fertilizers containing nitrogen, phosphoric acid, and potash (10 : 6 : 2) also gave favourable results. The only permanent solution of the problem, however, appears to lie in thorough eradication of the diseased plants. Bunchy top of bananas was prevalent among Latundan plants in Santa Rita, Pampanga [ibid., vi, p. 341]. Heart rot and leaf spot (*Mycosphaerella musae*) were observed on bananas in San Juan Heights.

In a few tests of disinfectants for the control of the bacterial disease of tobacco resembling wildfire [*Phytomonas tabaceara*: ibid., vii, p. 143] at the Ilagan Tobacco Station (Luzon), a solution of 1 in 1,000 mercuric chloride proved superior to silver nitrate at the same strength, though the former caused somewhat more delay in germination. Observations were also made on a green spot on Sumatra wrapper tobacco at the Sarunayan Station (Mindanao), the causal organism of which has not yet been determined.

Bark rot of citrus [ibid., v, p. 283; vii, p. 629] was prevalent in a number of districts. The total number of trees affected by this disease in the province of Batangas (where a regular control campaign is in progress) was 3,081, while 2,655 were treated.

Leaf spot of coffee (*Micropeltis mucosa*) was reported from Juban, Sorsogon.

Papaw fruits were infected by *Colletotrichum papayae*, *Clado-*

sporium sp., and *Fusarium* sp., while *Cercospora* sp. occurred on the leaves.

Phyllosticta hortorum was found causing fruit rot of eggplant.

STANER (P.). **Belgian Congo: some pests new to the Colony.**—*Internat. Rev. of Agric.*, N.S., xix, 8, pp. 744, 1928.

The author continues his enumeration of fungi new to the Belgian Congo [*R.A.M.*, vii, p. 562] and includes the following: *Stagonospora macrospora* on *Agave*; *Phyllosticta* sp. on *Furcraea*, *Aloë africana*, and *Ravenala madagascariensis*; *Isaria* sp. on *Acalypha*; and *Colletotrichum* sp. causing fibre rot of *Sansevieria cylindrica* and *S. fasciata* (all at Eala). *Gloeosporium phomoides* causes anthracnose of tomatoes at Libenge (Ubangi) [ibid., v, p. 519], followed by a saprophytic form of *Sclerotinia*. Melon plants at Stanleyville are subject to a sudden wilting caused by *Bacillus tracheiphilus* [ibid., vii, p. 72]. *Botryosphaeria* sp. occurs on *Vossia procera*, a saline herb growing on the banks of the Ubangui.

DADE (H. A.). **The relation between diseased cushions and the seasonal outbreak of 'black pod' disease of Cacao.**—*Gold Coast Dept. of Agric. Year-Book 1927* (*Bull.* 13), pp. 85–88, 3 col. pl., 1928.

In 1927 the author extended his studies on black pod disease of cacao (*Phytophthora faberi*) [*P. palmivora*], with special reference to the mode of hibernation of the causal organism in the Gold Coast [*R.A.M.*, vi, p. 657].

The results of a farm survey in two districts showed that the bulk of the infections occurring at the beginning of the season were definitely associated with the presence of deeply seated disease in the cushions, isolations from which yielded cultures of *P. palmivora*. There is no doubt, therefore, that the fungus can survive the dry harmattan wind season (December and January) in cushions, and that this is the principal and most effective method of renewal of the seasonal activity of *P. palmivora* as a pod pathogen.

Dissection of diseased cushions shows that the adjacent bark is more or less involved, with the formation of typical bark cankers, the infected portions of the cushions being continuous with the cankers. In the peduncle the affected tissues are of a water soaked, greyish-green tinge, with reddish edges and traversed by reddish lines. They become claret-coloured with age, then black and dry. When the peduncular trace is affected it turns first light brown and then black. From the cushion, infection proceeds into the surrounding bark, spreading vertically downwards for two or three (occasionally five or six) inches and laterally or upwards for a short distance.

In the cases of canker investigated by the author the diseased bark only became claret-coloured with age, apparently after the death of the fungus. In the early stages the presence of bark infection cannot be detected without shaving away the outer layers. The colour of the freshly exposed recently infected bark is a pale maroon, with brighter reddish-brown edges. This appearance is

produced by numerous wavy red lines, between which the tissues are of a very pale pinkish-fawn colour. After a brief exposure to air the entire surface darkens to claret colour and the network of fine, zonate lines disappears. The canker penetrates the bark and blackens the wood.

Pod infection due to diseased cushions cannot be readily diagnosed by inspection but may be detected by lightly scraping the peduncle of suspected pods with a knife or the finger-nail, when the colour of the exposed surface is found to be greyish-green with reddish edges, traversed by red lines, instead of bright green. When the pods are infected from some external source, instead of becoming invaded by extension from the cushion, the peduncle shows no discoloration except in the most advanced stages. Infection from the cushion usually travels along the side of the peduncle adjoining the diseased part of the cushion, and, when it reaches the pod, spreads more rapidly laterally than longitudinally, mainly through the cortical tissues. The five vascular strands lying in the axis of the pod very soon turn black.

In normal trees five or six inches is about the maximum length of the cankers connected with diseased cushions. The few cases of serious canker injury observed in the Gold Coast have been associated with unusually unfavourable environmental conditions. The active stage of cushion infection, as described above, probably lasts two or three years, the cushion eventually becoming so much involved that fruit production ceases. The cushions become infected originally by extension into them of infection from a pod that has become attacked from some external source (e. g., by spores). When all diseased pods are systematically removed, cushion infection is rare. Under such favourable conditions for the growth of the tree as in the Gold Coast, bark cankers in normal trees heal after some years. The dead bark rots away and the outer cortex cracks, dries, and curls inward into the cavity. The cushion also decays, leaving a shell of dried outer bark and fragments of peduncles. Cambial regeneration begins directly the canker ceases to spread and the renewal of the bark progresses rapidly.

DADE (H. A.). **A comparison of the pathogenicity of various strains of Phytophthora faberi, Maubl., on Cacao pods, etc., in the Gold Coast.**—*Gold Coast Dept. of Agric. Year-Book 1927* (*Bull.* 13), pp. 89-92, 1928.

A comparative examination [the results of which are tabulated] was made of ten strains of *Phytophthora faberi* [*P. palmivora*] from the following sources: (1) coco-nut bud rot, Jamaica; (2) coco-nut palm, India; (3) *Hevea* rubber black thread, Federated Malay States; (4) Sea Island cotton boll rot, St. Vincent; (5) cacao pod rot, Trinidad; (6) *Mimusops* fruit rot, Gold Coast; (7) cacao pod rot, Philippines; (8) citrus blight, Philippines; (9) cacao pod rot, Gold Coast (1925); and (10) the same (fresh isolation).

Twenty Criollo and twenty Amelonado pods were used in artificial inoculations with each of these strains, half the pods being wounded and half left intact. The pods were kept in a saturated atmosphere at a temperature of 75° to 82° C. Strains (3), (4), and

(8) were found to be unable to parasitize cacao pods. Strain (6) was a feeble wound parasite at the time of its isolation in 1924, since when it seems to have lost all pathogenicity. Strains (1) and (2) are somewhat doubtful wound parasites. Strain (7) was found to be only very weakly parasitic under the conditions of these tests. Strain (5), the Trinidad cacao pod organism, was actively parasitic on wounded and unwounded pods and is considered to be identical with the Gold Coast form, of which the old strain (9) was found to be distinctly less virulent than the fresh isolation (10).

Oospores were obtained by growing strains (6) and (9) together on cacao pods, but an attempt to secure the development of these bodies on rubber and cotton by inoculation with pairs of several of the above-mentioned strains gave negative results.

DADE (H. A.). **Dissemination of Cacao pod diseases by invertebrates.**—*Gold Coast Dept. of Agric. Year-Book 1927* (*Bull.* 13), p. 93, 1928.

Early in the 1927 season the writer observed an unusually large number of cacao trees heavily attacked at the Aburi agricultural station by mealy pod disease (*Trachysphaera fructigena*) [*R.A.M.*, ii, p. 497]. Close observation showed that the affected trees were infested by two species of ants which were eating the conidia of the fungus and in some cases carrying them away. The conveyance of spores by ants is stated to form an effective means of dissemination of mealy pod disease. Large numbers of the conidia have also been found in a viable condition in the excreta of a small, flat snail commonly occurring on cacao farms.

SCOTT (J. L.) & HUDSON (W. R.). **Effect of sea water on mould in Cacao beans.**—*Gold Coast Dept. of Agric. Year-Book 1927* (*Bull.* 13), pp. 62–66, 1928.

The results [which are tabulated] of experiments to ascertain the effect of wetting with sea water on the development of mould in cacao show that the maximum amount of damage is done during the first week after wetting, after which the rise is more gradual. In three series of tests, the amount of infection increased from 3·7, 1·9, and 2·4 per cent. to 50·8, 41·6, and 49·8 per cent., respectively, during the first week after wetting with salt water, the corresponding figures three weeks later being 61·2, 72·2, and 76·2 per cent. No significant difference was found between salt and fresh water as agents in the production of mould on cacao beans. Drying immediately after wetting was found to prevent the development of mould, whereas every day lost in removing moisture from the beans resulted in a further deterioration of the cacao [cf. *R.A.M.*, vii, p. 22].

NEILL (J. C.). **Survey of diseases of cereals in New Zealand.**—*New Zealand Journ. of Agric.*, xxxvii, 2, pp. 89–93, 1928.

Brief notes are given on the prevalence and severity of some common diseases of cereals in New Zealand between 1925 and 1928, together with tables showing the percentages of the crops examined which were found to be affected.

HARRINGTON (J. B.) & SMITH (W. K.). **The reaction of Wheat at two stages of growth to stem rust.**—*Scient. Agric.*, viii, 11, pp. 712–725, 1928.

The authors tabulate and discuss the results of their investigation, conducted in the greenhouse over a period of two years, on the relationship between the reaction of wheat plants to stem rust (*Puccinia graminis*) (*a*) in the seedling stage, and (*b*) after heading [see next abstract]. The varieties of wheat used were Marquis, Marquillo, Iumillo, and Vernal, and each was exposed to infection with physiological forms 17, 21, and 26, all prevalent in western Canada [*R.A.M.*, vii, p. 567]. The scale used to denote the type of infection was that adapted by Harrington [ibid., iv, p. 598] from the system of Stakman and Levine, and extended from 0 (= no uredosori but only infection flecks) to 4+ (= large, confluent uredosori with no chlorosis or flecks).

The results showed a distinct positive correlation between seedling reaction and infection after heading in the material examined. Plants having type 4 infections as seedlings showed, after heading, higher percentages of rust and wider pustules than those with type 4 –, which in their turn were less resistant than those showing type 3 as seedlings, and so forth. Plants showing infection types 0 to 3 – in the seedling stage were found to be resistant after heading. The after-heading reaction in the greenhouse was found to be very similar to that observed in rust nurseries.

SMITH (W. K.). **Spike emergence in Wheat hybrids.**—*Scient. Agric.*, viii, 12, pp. 795–796, 1928.

A study was made at Saskatchewan University of the F_2 population of a cross between wheats of the species *T. dicoccum* and *T. vulgare* with respect to their reaction to stem rust [*Puccinia graminis*: see preceding abstract]. The susceptible portion of the population was harvested when the majority of the plants had headed out. These susceptible plants had not attained their maximum height, and an attempt was made to ascertain what this would normally be by measuring the distance on ten resistant and partially resistant plants, from the crown to the top of the highest leaf sheath, and to the tip of the spike if it had emerged. The resulting data [which are tabulated] showed that no growth took place between the crown and the top of the upper sheath after the spike began to emerge. Therefore, if a close correlation exists between the height to the top of the sheath and that to the tip of the spike, the former character can be used as a reliable index of the total height of the plant. In view of the high correlation coefficient ($0{\cdot}83 \pm 0{\cdot}017$) obtained between these two heights in 132 hybrids, it was found possible to use this method to determine the relation between height and reaction to several forms of stem rust.

GOULDEN (C. H.), NEATBY (K. W.), & WELSH (J. N.). **The inheritance of resistance to Puccinia graminis tritici in a cross between two varieties of Triticum vulgare.**—*Phytopath.*, xviii, 8, pp. 631–657, 8 figs., 1928.

A cross was made between Marquis wheat and H-44-24, a *vulgare* derivative from a Marquis × Yaroslav emmer cross, with a

view to obtaining further information on the inheritance of resistance to wheat rust (*Puccinia graminis tritici*).

The H-44-24 parent is moderately resistant in the seedling stage to several forms of *P. graminis*, including 14 and 21, and highly so to form 36. Marquis is susceptible to a large number of forms, including 36 and 21, but highly resistant to form 14.

The high degree of resistance of H-44-24 to form 36 is dominant in the F_1 generation, whereas its moderate resistance to form 21 is recessive. Tests on 1,000 F_3 families [the results of which are tabulated] clearly indicated the existence of a difference between the parents of two pairs of factors for resistance to form 36, and this probably applies also to resistance to form 21.

Studies of the behaviour of F_4 lines breeding true for reactions to forms 21 and 36 showed that all the lines possessing moderate resistance to form 21 and high resistance to form 36 reacted to seven forms (including form 14) in the same way as H-44-24, whilst those possessing susceptibility to forms 21 and 36 reacted in the same way as Marquis. Further experiments indicated that the same factors govern resistance to one form and susceptibility to another.

First generation plants susceptible to form 21 in the seedling stage showed very great resistance to the same form as they approached maturity. Studies of the field reaction of one group of F_3 lines breeding true for susceptibility in the seedling stage to forms 21 and 36, and of another group breeding true for resistance to the same forms, showed that segregation in the field occurs quite independently, resistance under these conditions evidently being controlled by a single pair of factors only.

No tendency towards linkage between any of the following characters was observed: inheritance of mature plant resistance, seedling resistance to forms 21 and 36, awning, persistence of the glumes, and cotyledon colour.

LINDFORS (T.). **Om betydelsen av att beta höstutsädet.** [On the importance of disinfecting autumn seed-grain.]—*Landtmannen*, xi, 33, pp. 657–658, 1928.

In a further series of experiments on the control of various seed-borne diseases of cereals, the writer again obtained good results with uspulun-universal and germisan (0·25 per cent., 30 minutes' immersion) against wheat bunt [*Tilletia tritici* and *T. levis*] and *Fusarium* of rye [*Calonectria graminicola*: *R.A.M.*, vi, p. 26]. The last-named disease is also amenable to control by 15 to 20 minutes' immersion in 0·1 per cent. corrosive sublimate. In mild cases of bunt the wheat seed-grain may be dusted with abavit B (200 gm. per 100 kg.), tutan (200 gm.), or uspulun [tillantin R], but these preparations cannot be generally recommended as effective substitutes for the liquid methods. Sprinkling with vetefusariol has also given successful results.

PLAUT (M.). **Auswinterung und Saatgutdesinfektion.** [Winter injury and seed disinfection.]—*Nachricht. über Schädlingsbekämpf.*, iii, 3, pp. 77–81, 1928.

According to the official statistics of the German Plant Protec-

tion Service, the amount of damage caused to the cereal crop by winter injury (*Fusarium*) [*Calonectria graminicola*] during 1927–8 ranged from 10 to 100 per cent. in the Saxon Free State and from 20 per cent. upwards in other provinces, reaching 66 per cent. in Schleswig-Holstein and 80 per cent. in parts of Württemberg. Tables are given showing the incidence of infection on wheat and rye in the different provinces from 1920 to 1926, inclusive. Excellent results have been obtained in the writer's experiments at Hamersleben [Saxony] in the control of winter injury, stripe disease of barley [*Helminthosporium gramineum*], and wheat bunt [*Tilletia tritici* and *T. levis*], by 25 to 30 minutes' immersion of the seed-grain in uspulun-universal at varying concentrations, dusting with 0·2 or 0·3 per cent. tillantin or copper carbonate being somewhat less reliable.

HILGENDORFF (G.). **Über die Bestimmung der Haftfähigkeit von Trockenbeizmitteln.** [On the determination of the adhesiveness of disinfectant dusts.]—*Fortschr. der Landw.*, iii, 16, pp. 725–729, 1928.

The author undertook a series of experiments [the technique of which is described and the results tabulated and discussed] to determine the degree of adhesiveness to wheat and rye seed-grain of various disinfectant dusts used for the control of cereal diseases. It was found that, to secure full adhesion, contact for a period varying from two to five minutes was required. Wrinkled seed-grain, e.g., Kirsche's Dickkopf and Hohenheim wheat varieties, took up less dust than the smooth types, such as Strube's summer wheat. The finely granular brands of copper carbonate are more adhesive than those with coarser particles. Contamination of the seed-grain with foreign substances reduced the adhesive capacity of the former. It was shown that wheat and rye seed-grain can take up considerably more than the average quantity of dust (300 gm. per 2 cwt.) required for disinfection.

MENCACCI (M.). **Trattamenti dei semi di Grano, Avena, et Orzo con uspulun, germisan, kalimat e abavit.** [Seed treatments of Wheat, Oats, and Barley with uspulun, germisan, kalimat, and abavit.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 2, pp. 221–225, 1928.

During 1926–7, tests [the results of which are tabulated and discussed] of the effect on germination of uspulun, germisan, kalimat, and abavit when used with cereal seed-grain [*R.A.M.*, v, p. 729] showed that three lots of wheat seed and one of oats when treated with uspulun dust [tillantin R] (3 parts by weight per thousand) yielded, respectively, 6·72, 6·915, 6·31, and 7·57 kg., as compared with 6·09, 6·18, 5·56, and 7·16 kg. in the untreated controls. On the other hand, immersion of one lot of wheat seed and two lots of oats in a 0·15 per cent. solution of uspulun for one hour, in each case reduced the yield as compared with the control. Immersion of wheat seed for 30 and 45 minutes, respectively, in a 0·75 per cent. solution of germisan gave yields of 6·41 and 6·43 kg., as compared with 6·23 and 6·18 kg. in the controls. Wheat seed immersed for 30 minutes in a 0·25 per cent. solution of kalimat

gave a yield of 6·57 kg. as compared with 6·16 kg. in the control. Treatment of rye seed with abavit dust (2 parts by weight per thousand) slightly reduced the yield.

SVOBODA (F.). **Vliv obsahu tmavých (snětivych) odpadků mlýnských v otrubách na stravitelnost obsažených živin.** [Effect of the content of dark (smutted) milling offals in bran on the digestibility of its nutrient constituents.]—*Ann. Czecho-Slovak Acad. of Agric.*, Prague, iii, 2, pp. 289–297, 1 pl., 1 fig., 1928. [German summary.]

In continuation of Weiser's researches [*R.A.M.*, v, p. 478] the author made feeding experiments on sheep at the Bratislava [Pressburg, Czecho-Slovakia] Agricultural Experiment Station to test the effect of the admixture of small quantities of bunt spores [*Tilletia tritici* and *T. levis*] in bran on the digestibility of the nutrient constituents of the latter. The results showed that up to 0·6 per cent. the admixture of the spores did not appreciably affect the food value of the bran, but 1 per cent. reduced the digestibility coefficient of the nitrogenous constituents by as much as one-fifth. The reduction in the digestibility of these substances progressed in direct ratio to the increase in the percentage of admixture above 0·6. It is thought probable that the effect on the digestibility of the other constituents was similar.

KRAUSS (J.). **Beitrag zur Methodik der Beizmittelprüfung im Laboratorium.** [Contribution to the methods of testing disinfectants in the laboratory.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, viii, 8, pp. 71–72, 1928.

A method is described of testing the efficacy of disinfectants against bunt [*Tilletia tritici* and *T. levis*] in the laboratory under standardized conditions, with the object of obtaining comparable results in different localities in germination tests that are made in fine earth or the like so as to simulate the action of soil in neutralizing the toxicity of the disinfectants. The spores are germinated in Petri dishes on a layer of slate dust (100 gm. per 50 c.c. of distilled water), below which is a foundation of sand (300 gm. per 5 c.c. of water). The slate dust (2 kg.) is previously mixed with 4 l. of saturated lime water and 2 l. of tap water, stirred into a paste, decanted, washed several times, and decanted again. The period of immersion in the various disinfectant solutions used was 30 minutes and the steeping temperature was 16° to 17° C. In a comparative series of tests it was found that germination was more rapid and uniform on fine soil than on slate dust; on the other hand, the disinfectants were deprived of toxicity to a much greater extent on the latter substratum, thereby providing a severe test of the efficacy of the treatments.

BORCHHARDT (A. I.). Минеральный малахит, как противоголовневый фунгисид. [Mineral malachite as an antismut fungicide.]—*Protection of Plants in Ukraine 1927–1928*, 3–4, pp. 56–72. [Received November, 1928.]

Details are given of experiments made in 1926 and 1927 to test the fungicidial value of a powder prepared from green malachite

[$CuCO_3 . Cu(OH)_2$] in the control by seed dusting of cereal smuts, particularly wheat bunt [*Tilletia tritici* and *T. levis*]. In 1926 the results were unsatisfactory, presumably owing to the coarseness of the dust obtained by crushing the ore by hand in a mortar. In 1927, however, when a sufficiently fine degree of trituration was arrived at, the dust gave, in the case of wheat bunt, results at least equal to those obtained with a wide range of foreign liquid and dust fungicides [a list of which is given] which were tested at the same time. Millet smut [*Ustilago panici-miliacei*] was only partly controlled by the dust, a fact which is ascribed to the smooth surface of the grain, since entirely comparable results were also obtained with the other dusts tested. The main advantages of the new dust, from the point of view of the Ukrainian cereal grower, are its cheapness, as the ore is obtained at low cost from the Ural mountains, the ease of application, and the possibility of treating the seed-grain long before sowing, as the dust does not undergo any chemical alteration in storage.

TAYLOR (J. W.). **Effect of the continuous selection of large and small Wheat seed on yield, bushel weight, varietal purity, and loose smut infection.**—*Journ. Amer. Soc. Agron.*, xx, 8, pp. 856–867, 1928.

Three times as many wheat heads infected by loose smut (*Ustilago nuda*) [*U. tritici*] occurred in plots sown with small seed-grain as in those sown with large in 1926, and over five times as many in 1927. The plots sown with small seed contained four times as many loose-smutted heads as unsorted Purplestraw seed.

SUBRAMANIAM (L. S.). **Root rot and sclerotial diseases of Wheat.**—*Agric. Res. Inst., Pusa, Bull.* 177, 7 pp., 1 pl., 1 fig., 1928.

Wheat plants from Dharwar, Bombay, examined in December, 1919, showed a soft, brown discoloration of the collar, accompanied by shredding of the blackish-brown leaf sheaths. The discoloration of the stem extended up to the first node. In many cases the subterranean portions of the plants were soft and blackish.

Microscopical examination of sections from the diseased collar revealed a yellowish-brown discoloration of the whole tissue, while gum was present in nearly all the cells. The vascular bundles were found to be completely obstructed by a hyaline, granular, rarely septate, irregularly branched mycelium, 3 to 7 μ thick, while smooth, hyaline to pale brown oospores were observed in the decayed portions of the roots and leaf sheaths.

The fungus, a species of *Pythium*, was isolated from near the collar of a diseased plant and cultured on oatmeal agar. The mycelium is septate only in old stages, and is furnished with toruloid buds, especially in water cultures. The sporangia resemble the hyphae, sometimes being cut off from the main branches by septa. The zoospores, numbering 15 to 48, are 8 to 11 μ in diameter. Conidium-like bodies, at first indistinguishable from the oogonia but later becoming vacuolate and germinating by three or four germ-tubes, are found in old cultures. The spherical, hyaline oogonia, measuring 16·5 to 28·6 μ, are lateral, terminal, or inter-

calary. The antheridia are clavate and flattened at the tip; they generally arise from the branch bearing the oogonia. Usually there is only one antheridium, but two to four may be found. Thus, in the intercalary oogonium one antheridium arises from each side of the oogonial stalk, while in other cases a hypha arises from the branch bearing the oogonium, a short distance below the latter, curves towards the oogonial wall, and then branches freely, forming two to four antheridia, all of which adhere to the same oogonium. The oospores measure 15·4 to 26·4 μ and nearly always fill the oogonium completely. Their germination was not observed.

The fungus differs from *P. aphanidermatum* [*R.A.M.*, vii, p. 488] in the branched antheridium and the oospores entirely filling the oogonium, and from *P. monospermum* Prings. in its larger oospores and parasitic habit. It accords well, however, with the description and figures of the *Pythium* investigated by Carpenter on sugarcane in Hawaii [ibid., iii, p. 484] (oogonia 24 to 35 and oospores 21 to 28 μ in culture), the slightly smaller dimensions of the Indian organism not being considered a sufficient reason for the separation of the two fungi. The name *P. graminicolum* n. sp. is proposed for the wheat parasite.

In February, 1917, an examination of diseased wheat plants from Mandalay, Burma, showed a brown or black discoloration, especially of the collar and leaf sheaths and sometimes extending up to the first two nodes from the base. The leaf sheaths were matted together by a weft of white mycelium, strands of which covered the inner surfaces of the leaf sheaths and stems. The roots were discoloured and brittle. The disease occurred only in a sporadic form.

A hyaline, septate mycelium with numerous clamp-connexions was present in all the tissues, especially those of the vascular bundles. The fungus was identified as *Rhizoctonia destruens* [*Sclerotium rolfsii*: ibid., vii, pp. 304, 541].

In 1920 the same fungus attacked wheat seedlings and mature plants in the Central Provinces, causing similar symptoms to those described above. The seedlings succumbed and adult plants became stunted and failed to form grain. Inoculation experiments on potted wheat seedlings gave positive results. The symptoms occurring on wheat in India agree fairly closely with those described by Godfrey (*Phytopath.*, viii, p. 64, 1918) as caused by *S. rolfsii* in the southern United States.

RHIND (D.). **India: mycological notes on Burma.**—*Internat. Rev. of Agric.*, N.S., xix, 8, pp. 744–745, 1928.

Since 1926, when a species of *Sphacelia* was found for the first time in a very severe form on sorghum at Mandalay, the disease caused by this fungus has spread rapidly on the long-glumed varieties grown mainly for fodder. *Cerebella sorghi-vulgaris*, which flourishes on the sugary excretion exuded by the *Sphacelia* [*R.A.M.*, vi, p. 398], is nearly always present on infected plants, apparently preventing the formation of sclerotia by the latter fungus. A species of *Sphacelia*, accompanied by *C. cynodontis*, was also recorded on *Panicum prostratum*.

PETRI (L.). **Il 'mal secco' dei Limoni in rapporto all' incoltura.** ['Mal secco' of Lemon trees in relation to neglected cultivation.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 2, pp. 216–221, 3 pl., 1928.

In 1926 a lemon grove in the vicinity of Messina, in which 'mal secco' due to *Colletotrichum* [*gloeosporioides*: *R.A.M.*, vii, p. 162] was present, and where no cultural precautions had previously been taken, was given various applications of fertilizers, iron sulphate, and lime, the soil also being dug over and the dead branches cut away. One section was left untreated. In March, 1928, all the trees were still living, but those in the untreated block were unhealthy while the others were flourishing. In April, however, nearly all the untreated trees died. Their death could not be attributed to drought, as rainfall had been copious, but it was found that the owner had recently manured and cultivated the previously untreated block, and this had apparently killed the already weakened trees. Similar injurious effects of manuring trees severely affected by *C. gloeosporioides* are stated to have been previously reported.

These observations are believed to support the view that the parasitism of *C. gloeosporioides* is closely dependent on nutritive and other environmental conditions. It is also considered possible that a disturbance of equilibrium between water absorption and transpiration, consequent on the breaking of numerous rootlets during manuring, may also have favoured the progress of the fungus. If cultural precautions are too long delayed, the progress of infection may actually be accelerated by them.

DUPONT (P. R.). **Annual Report of the Seychelles Department of Agriculture for the year 1927,** 5 pp., 1928.

The following items of phytopathological interest occur in this report. Coco-nut leaf stalks were found to be infected by a strain of *Ceratostomella fimbriata*, apparently distinct from those causing mouldy rot of the tapping cut of *Hevea* rubber in Malaya and black rot of sweet potatoes in America, respectively [*R.A.M.*, v, pp. 184, 628, 689 *et passim*]. The scale insects, *Pinnaspis buxi* and *Ischnaspis filiformis*, which cause severe damage to coco-nut palms in many tropical countries, were parasitized, respectively, by an apparently undescribed species of *Kusanoa* (hitherto known only from Japan) and by *Septobasidium* sp. A case of gumming disease of coco-nuts similar to that reported from Zanzibar, Tanganyika, the Philippines, and Kenya as due to *Colletotrichum* sp. [ibid., v, p. 608; vi, p. 533] was observed.

DAVID (P. A.). **Note: introduced Coffees lose resistance to the rust fungus Hemileia vastatrix Berkeley and Broome.**—*Philipp. Agric.*, xvii, i, pp. 45–49, 1928.

In 1889 the rust fungus (*Hemileia vastatrix*) destroyed many plantations of Arabian coffee in the Batangas Province of the Philippine Islands. During the period 1910 to 1916 different varieties of supposedly resistant types of Arabian, Liberian, and

Robusta coffee from Java and elsewhere were introduced into the Philippines, where they have since been under observation for their reaction to the leaf disease.

The results [which are tabulated] of systematic observations on the behaviour of these varieties at different altitudes have shown that all are subject to infection by the fungus at altitudes of 80 to 450 m. above sea level. Trees shaded by *Gliricidia maculata*, *Leucaena glauca*, and *Erythrina fusca* were found to grow more vigorously and to be less susceptible to rust than those in exposed situations. The Arabian type is the most susceptible and the first to be seriously injured, while the Liberian may resist for some years but ultimately becomes susceptible. Robusta is intermediate between the other two. It is, therefore, considered inadvisable to extend the plantings of imported Robusta and Liberian varieties, since on prolonged exposure they become equally susceptible with the Arabian type.

STOUGHTON (R. H.). **The influence of environmental conditions on the development of the angular leaf-spot disease of Cotton.**—*Ann. of Appl. Biol.*, xv, 3, pp. 333–341, 1 pl., 3 figs., 1928.

A detailed description is given of the apparatus used by the author in his experiments in 1927 on the inoculation of cotton plants with *Bacterium malvacearum* [*R.A.M.*, vii, p. 510] under controlled conditions of temperature and humidity. At high relative humidities (over 80 per cent.) no infection was obtained at temperatures above 32° C., while at that temperature the infection was only very slight. It would therefore appear that under conditions of very high relative humidity, 32° is the maximum temperature at which infection can occur. At these humidities, however, moderate to heavy infection was obtained at temperatures of 24° to 28°. At 70 per cent. relative humidity infection was slight at 25°, and at lower humidities no infection was obtained at the temperatures tested (28° to 29°). Further experiments are being made to determine how far the limiting temperature varies with the degree of humidity and vice versa.

SCOTT (H. H.). **Reports on deaths occurring in the Society's Gardens during the year 1927.**—*Proc. Zool. Soc. London, 1928*, pp. 81–119, 1928.

Notes are given on cases of mycosis occurring among the animals in the Zoological Society's Gardens during 1927. *Aspergillus fumigatus* was isolated from the spleen of a Burnett's cercopitheque monkey suffering from a disease of the liver and spleen characterized by small miliary deposits in the former organ and by lesions measuring 2 mm. to 1 cm. in diameter in the latter. The same fungus was further found in the posterior air-sacs, right lung, peritoneum, spleen, and kidneys of a glossy ibis (*Plegadis falcinellus*), which contracted tuberculosis apparently as a secondary result of mycotic infection [cf. *R.A.M.*, vii, p. 632].

LEINATI (F.). **Micosi rare in animali. Osservazioni cliniche e sperimentali.** [Rare animal mycoses. Clinical and experimental observations.]—*Atti R. Accad. Fisiocritici Siena,* Ser. X, iii, 1, pp. 83–92, 3 pl., 1928.

The author's clinical and experimental studies on *Mucor racemosus* and *Fusarium moronei,* isolated from a dog [*R.A.M.*, vii, p. 721], are fully described. Inoculation tests on rats and guinea-pigs showed that the former organism is the more pathogenic of the two; the latter is chiefly interesting as the first member of the genus *Fusarium* known to parasitize animals.

WHITE (C.). **Studies in mycotic dermatitis. II. Mycotic inguinal lymphadenitis associated with superficial fungus dermatitis of the feet.**—*Arch. of Dermatology,* xviii, 2, pp. 271–275, 1928.

Full clinical and mycological details are given of a case of mycotic inguinal lymphadenitis in a twenty-year-old gardener. *Trichophyton interdigitale* was isolated from an inguinal lymph node associated with, and undoubtedly infected secondarily from, a superficial fungous eruption of the feet: the same organism was recovered from the primary focus. The author believes that this type of infection of the lymph node from superficial dermatomycoses has not previously been reported, and the case is regarded as being of particular interest as showing that fungi may enter the lymphatic glands from such a superficial dermatitis as ringworm of the toes.

PIRANI (A.). **Su di un saccaromicete simulante il mughetto nei bambini.** [On a Saccharomycete simulating thrush in infants.] —*Ann. d'Igiène,* xxxviii, 8, pp. 643–647, 1928.

From the buccal cavity of an infant suffering from a condition resembling the common thrush, due to *Oidium* [*Candida*] *albicans* [*R.A.M.*, vi, p. 33], the author isolated a yeast having oval spores measuring 3 to 4 μ and showing a general similarity to Rivolta's *Cryptococcus* [*C. farcinimosus*: ibid., vii, p. 325]. The fungus grew well on a number of standard media at 27° C. The results of inoculation experiments on animals [which are fully described] indicate that the pathogenicity of the fungus is not due to the secretion of toxins during the life of the organism but to the liberation of toxic decomposition products on its death. There was a marked loss of pathogenicity in culture.

MAGALHÃES (O. DE). **Ensaios de mycologia.** [Studies in mycology.]—*Mem. Inst. Oswaldo Cruz,* xxi, i, pp. 173–188, 6 pl., 1928. [Portuguese, with English translation.]

Full clinical, cultural, and microscopical particulars are given of a new species of *Microsporon, M. circuluscentrum,* isolated from the scalp of a female white Brazilian infant in 1921. The fungus is characterized by a septate mycelium with hyphae 2·3 μ broad, spores 3·5 μ in diameter, terminal, lateral, or intercalary chlamydospores measuring 10·5 μ, and fusiform organs 23 by 7 μ. Inoculation experiments gave negative results on guinea-pigs but

produced the typical symptoms of the disease (circinate, pinkish lesions and slight pruritus) in man.

Burgess (R.). **A contribution to the study of the microbiology of wool.**—*Journ. Textile Inst.*, xix, 8, pp. T315–T322, 1928.

In this paper it is stated that examination of mildewed woollen and worsted goods shows that 'tendering' [*R.A.M.*, iv, p. 281] is progressive and is initiated by the dissolution and removal of the epithelial scales, followed by the isolation of the spindle-shaped cortical cells of the hair. The following bacteria and fungi were found in pure culture to be able to attack wool fabric previously sterilized by discontinuous steaming: *Bacillus mesentericus*, *B. subtilis*, *B. mycoides*, *Actinomyces* sp., two species of *Fusarium*, *Cephalothecium roseum*, *Aspergillus niger*, *A. fumigatus*, and two other species of this genus, *Penicillium brevicaule* and three other species, *Acrostalagmus* sp., and *Trichoderma* sp.

When the wool was completely submerged in water, *B. mesentericus* did not cause tendering when the P_H value of the liquid was under 6·5, while the degree of tendering in alkaline media was proportional to their alkalinity up to a point not yet ascertained. *Aspergillus* sp. grew well on all the acidified samples, the P_H value of the most acid liquid being 3, but the damage caused was slight; it did not grow on wool submerged in slightly alkaline liquids.

When the wool was just in contact with water, acidification retarded the growth of *B. mesentericus* but promoted that of the *Aspergillus*; the reverse was the case when the wool was alkaline.

When the wool was not in contact with water, but was kept in an atmosphere saturated with water vapour, acidification checked decay by *B. mesentericus* but did not hinder mould growth. The effect of alkali under these conditions was not ascertained. There were indications that sulphuric and hydrochloric acids were more effective in checking mildew than were the organic acids.

With regard to the relationship between the production of mildew and the moisture content of wool, the organisms concerned apparently require different amounts of water, but the differences vary only within narrow limits. The author suggests that moulds may be able to develop on wool the moisture content of which is too low to support bacterial growth, and that by their respiration they may increase that content to the minimum necessary for bacteria. Some support was also forthcoming for the view that the intensity of the discoloration caused by moulds may not be a criterion of the degree of damage, and that bacteria are much more active wool destroyers than fungi [loc. cit.]. Frequently, wool with a thick covering of fungal hyphae was found to be only slightly damaged, whereas the yellowish-brown stain characteristic of bacterial action is stated to be almost always accompanied by advanced tendering. Until more data have been obtained, the question whether mildew will develop on wool in an atmosphere having a constant relative humidity of less than 100 per cent. must be left open.

Experiments with a view to discovering a suitable antiseptic for the control of mildew in wool are stated to have given encouraging results; the addition to certain commercial conditioning fluids of

sodium silico-fluoride gave the material a considerable resistance to mildew, and further tests with this substance are in progress.

Fabrics treated with various commercial dyes were inoculated with *Aspergillus* and *B. mesentericus*, air-dried, and incubated at room temperature for five months in a saturated atmosphere. Out of 72 samples 27 were undamaged, and of the latter 24 had been chrome dyed. Of the remaining samples, all of which developed tendering, only one was chrome dyed. It is suggested that the immunity following chrome dyeing is related to its waterproofing properties.

VAN BEYMA THOE KINGMA (F. H.). **Ueber ein gerbstoffzerstörendes Penicillium aus Sumatra, Penicillium phaeo-janthinellum Biourge.** [On a tannin-destroying *Penicillium* from Sumatra, *Penicillium phaeo-janthinellum* Biourge.]—*Mitt. 'Centraal Bureau voor Schimmelcultures', Verh. Akad. Wet. Amst.*, II Sect., xxvi, 2, p. 21, 1928.

A species of *Penicillium*, submitted to the Centraalbureau voor Schimmelcultures, Baarn (Holland), from Medan, Sumatra, was reported to be capable, in conjunction with an *Aspergillus* allied to *A. niger*, of destroying the tanning material known as 'gambir', extracted from the leaves of *Uncaria gambier*. The conidia of the fungus were found to measure 1·7 to 3·3, generally 2 to 3 μ. Biourge's Latin diagnosis of *P. phaeo-janthinellum*, with which the Sumatran organism is identified, is cited [cf. *R.A.M.*, iii, p. 178], and brief notes are given on its cultural characters.

MARTIN (G. H.) & JENKINS (ANNA E.). **Preliminary list of fungi and diseases of Roses in the United States.**—*Plant Disease Reporter, Supplement* 63, pp. 354–369, 1928.

This is a list of parasitic and saprophytic fungi and bacteria, together with a few diseases of undetermined origin, reported to the Office of Mycology and Disease Survey, Bureau of Plant Industry, as occurring on roses in the United States. The particulars supplied include the distribution, varieties affected where known, and date of first record. One or more bibliographical references are usually furnished under each disease.

LAUBERT [R.]. **Die fünf wichtigsten Krankheiten der Rosen und ihre Bekämpfung.** [The five most important Rose diseases and their control.]—*Biol. Reichsanst. für Land- und Forstwirtsch., Flugbl.* 93, 4 pp., 5 figs., 1928.

Brief, popular notes are given on the symptoms, life-history, and control of the following fungous diseases of roses: mildew (*Sphaerotheca pannosa*); black spot (*Actinonema* [*Diplocarpon*] *rosae*); rust (*Phragmidium subcorticium*); downy mildew (*Peronospora sparsa*), to which the wild variety, Laxa, is stated to be resistant; and brand canker (*Coniothyrium wernsdorffiae*) [*R.A.M.*, vi, p. 554; vii, p. 446], which is said to be particularly severe on the Crimson Rambler.

A new disease of Salvia.—*Plant Disease Reporter*, xii, 7, p. 81, 1928.

A diseased salvia plant collected at Brookhaven, Mississippi, in July, 1928, was found to be attacked by *Sphaeropsis salviae* Hollós, which is known to occur in Hungary but has not hitherto been reported from the United States.

WESTERDIJK (JOHANNA) & VAN BEYMA THOE KINGMA (F. H.). **Die Botrytis-Krankheiten der Blumenzwiebelgewächse und der Paeonie.** [The *Botrytis* diseases of flowering bulbs and of the Peony.]—*Meded. Phytopath. Lab. 'Willie Commelin Scholten', Baarn (Holland)*, xii, pp. 1–27, 3 pl., 10 figs., 1928.

A full description is given of the authors' morphological and cultural studies on seven species of *Botrytis* causing diseases of well-known flowering bulbs and of the peony.

Botrytis tulipae (with which *B. parasitica* is considered to be identical) [*R.A.M.*, iv, p. 285; vii, p. 378] is responsible for two distinct types of disease, one characterized by a complete arrest of growth and immediate rotting of the young leaves, stems, and buds, and the other popularly known as 'fire'. The latter phenomenon is restricted to the flowers and leaves of the late-flowering Darwin varieties: *Tulipa greigii* and the newly imported Bokhara tulips are sometimes completely rotted by the fungus. Pale lesions with reddish-brown margins appear on the affected parts, and may cause complete decay of the buds in damp weather. Early varieties, in addition to the above-mentioned arrest of growth, are liable to suffer from the so-called 'tip fire', in which the whole leaf rots from the tip downwards. Sclerotial development occurs mainly on the early tulips affected by the first type of disease. The risk of overwintering by means of these organs is much less with the Darwin and Cottage varieties. Care must be taken to distinguish this disease from that caused by *Sclerotium tuliparum* [loc. cit.].

The oval, spherical to elongated-spherical, hyaline or pale grey conidia, measuring 12 to 22 by 8 to 13 μ (average 15 to 18 by 8·5 to 11·5 μ), are borne on the small branches, arranged in umbels, of the erect, brownish-grey conidiophores. The spherical or elongated-spherical, velvety white (later intensely black) sclerotia measure 1 to 2 by 1 mm. and are generally deeply embedded in the infected tissue.

The so-called 'smoulder' of narcissus (*B. narcissicola*) [loc. cit.] is described as a typical young leaf and shoot rot which is apparent immediately the leaves emerge. The tips are shrunken and very often already covered with grey mycelium. Sometimes the stem base shows a characteristic slimy wet rot which may result in the complete detachment of the shoot from the bulb.

The sclerotia of the fungus develop at the tips of the outer bulb scales, with which infection is probably transmitted in most cases, though it may also proceed from the soil. The oval conidia, tapering towards the base, are pale brownish, smooth, with a finely granular content, and measure 8 to 16 by 7·5 to 12 μ (average 10 to 15 by 8 to 11 μ). This species of *Botrytis* is the only one of those studied which retained its capacity for conidial formation in prolonged culture on artificial media. The brownish-grey, simple or

branched conidiophores attain a length of over 1 mm. and a thickness of 16 to 20 μ (only 8 to 12 μ towards the tip). After the abstriction of the conidia the fertile branches present a very characteristic shrunken appearance.

B. galanthina [ibid., vi, p. 510 ; vii, p. 378] causes similar symptoms on freshly emerging snowdrops to those described under narcissus. The decay of the shoots may be so complete that nothing is left but a clump of conidia at soil level.

The spherical, oval, elongated, or irregular conidia measure 9·5 to 18 by 6·5 to 9·5 μ (mostly 10 to 17 by 7·5 to 8·8 μ), and are borne in heads of 40 to 50 μ in diameter on brown, simple or branched conidiophores up to 1 mm. in length. Sclerotia are formed in immense numbers on the rotting shoots, leaves, and occasionally on the bulbs. Pure cultures of *B. galanthina* closely resembled those of *B. tulipae*.

Hyacinths are also liable to a kind of 'fire' resembling that of tulips but mainly affecting the leaves, except in very cold weather, when the flowers are rapidly destroyed by a wet rot. In this case the sclerotia of the causal organism, which is named *B. hyacinthi* n. sp., only develop on the diseased above-ground parts and not on the bulbs, so that the risk of transmission is less than with *B. tulipae*.

The conidia of *B. hyacinthi* (which appears to have been formerly mistaken for *B. galanthina*), are greyish-brown, with a finely granular content, oval to spherical, and measure 13 to 19 by 10 to 14 μ (mostly 14 to 18 by 11 to 13 μ). They are borne in heads of 100 to 130 μ in diameter on erect conidiophores up to 0·5 mm. in height and 10 to 18 μ in width, clavate or irregularly broadened at the top and swollen at the base, brownish below, and almost hyaline towards the tip.

B. polyblastis, the causal organism of narcissus 'fire' in England, is described and figured from Dowson's studies [ibid., vii, p. 581].

B. elliptica (Berk.) Cke (with which the causal organism of Marshall Ward's 'lily disease' is identified) causes a disease of different varieties of cultivated lilies (especially of the Japanese Golden type), which may range from small, red-bordered spots on the leaves and petals to a typical tip rot reminiscent of that associated with the 'fire' disease of other flowering bulbs. This latter manifestation is associated with dull, damp weather at midsummer.

The hyaline conidia of the fungus are elongated-spherical or oval, and measure 16 to 34 by 10 to 24 μ (usually 20 to 28 by 13 to 18 μ). They are borne in heads of 75 to 85 μ in diameter on sparsely branched conidiophores, measuring up to 0·5 mm. in height. The two to four branches measure 200 to 325 μ in length and are provided with numerous sterigmata on which the conidia are borne. Numerous bicellular spores are frequently found below the conidia on the leaves. Sclerotia do not appear to be formed.

B. peoniae (Oudemans) Van Beyma [ibid., vi, p. 668] causes a dry, black rot of the young leaves and buds of peonies. *B. trifolii* and *B. cinerea* [ibid., vi, pp. 489, 510] can also produce similar symptoms on peonies.

VAN BEYMA THOE KINGMA (F. H.). **Ueber das Vorkommen von Penicillium corymbiferum Westling auf Tulpenzwiebeln.** [On the occurrence of *Penicillium corymbiferum* Westling on Tulip bulbs.]—*Meded. Phytopath. Lab. 'Willie Commelin Scholten', Baarn (Holland)*, xii, pp. 28–30, 1928.

In March, 1927, the writer observed the development of *Penicillium corymbiferum* on tulip bulbs from a Baarn nursery attacked by *Sclerotium tuliparum* [*R.A.M.*, vii, p. 378]. Shortly afterwards a fresh consignment of tulip bulbs was examined and the same *Penicillium* detected. In the latter case the bulbs were entirely covered with a white mycelium which was further found to have penetrated right through the interior. Of the shoot, only decayed, black remnants were left, the appearance suggesting that the bulb had been infected from the shoot. In places the outer sheath had entirely disappeared. The scales were hard and dry, presenting a spongy appearance on sectioning. The spherical, smooth, concatenate conidia measure 2·7 to 3·3 μ in diameter. The cultural characters of the fungus are described.

WEDGWORTH (H. H.). **Experiments on the control of a Narcissus root-rot.**—*Quart. Bull. State Plant Board Mississippi*, viii, 2, pp. 15–20, 2 figs., 1928.

Experiments are described in which narcissus bulbs grown in a greenhouse in Mississippi and affected with a root rot caused by a species of *Fusarium* were treated with various disinfectants. The best control was given by six hours' immersion in uspulun or semesan, though one hour's immersion in mercuric chloride, 1 in 1,000, also gave satisfactory results, the average weight of the treated bulbs per plot being, respectively, 880·6 and 840·1 gm., as compared with 667·3 gm. in the untreated controls.

HEINRICHER (E.). **Über einen Hexenbesen auf Cydonia japonica.** [On a witches' broom on *Cydonia japonica*.]—*Ber. Deutsch. Bot. Gesellsch.*, xlvi, 3, pp. 198–204, 3 figs., 1928.

The occurrence of a witches' broom on *Cydonia japonica* in the Innsbruck Botanic Garden is described. Some of the branches were hypertrophied and very full of sap, while others were elongated, tenuous, and crooked. The leaves were much reduced in size, vivid red on the upper and reddish-white on the under side, with a strongly marked network of veins. The causal organism could not be exactly determined, but is believed to be a species of *Exoascus* [*Taphrina*], probably *T. cerasi*, which occurs on neighbouring cherry trees.

GRANOVSKY (A. A.). **Alfalfa 'yellow top' and leafhoppers.**—*Journ. Econ. Entom.*, xxi, 2, pp. 261–266, 1928.

For the last twenty years 'yellows' or 'yellow top' of lucerne has been frequently reported from the eastern half of the United States. During the summers of 1926 and 1927 the disease was very common in Wisconsin, especially on the second crop [*R.A.M.*, vi, p. 490]. The discoloration usually begins in areas adjacent to grassy land, and gradually spreads over the entire field. The

growth of diseased crops is poor and the yield may be reduced by two-thirds.

The results [which are summarized] of controlled field and greenhouse experiments have demonstrated that the leafhopper *Empoasca fabae* is responsible for yellow top. Five or six days after placing leafhoppers collected at random from affected lucerne on to perfectly healthy green plants, the latter developed mottling and blotches, which subsequently fused, producing a striated discoloration between the lateral veins of the apical leaves. By the end of the second week the tops of the plants showed a deep yellow to orange discoloration, with bronzing of the edges of the leaves. In severe cases the affected leaves shrivelled and dried up. The diseased plants became badly stunted, with marked shortening of the internodes, considerable rosetting, and abundant proliferation of new dwarfed shoots in the leaf axes. The new leaves on the main stems and on the lateral shoots of infested plants were about a quarter of the normal size.

The symptoms of yellow top on older lucerne plants are much intensified by the prolongation of the time of leafhopper feeding or by the severity of the insect infestation. On one-year-old plants five leafhoppers per plant produce conspicuous symptoms in one or two weeks. Ten nymphs of later instars can cause severe injury to a plant in two weeks. Seedlings are always very badly stunted and often killed outright within a few days after the insects feed on them. The leaves, petioles, and upper portions of the succulent shoots were found to wither and collapse in from 24 to 48 hours as a result of the feeding of one leafhopper or nymph per leaf. Even the supposedly immune hairy variety was subject to the same symptoms as other varieties under the conditions of these experiments. The crowns of the lucerne plants in the infested cages were abnormally small, with only a few feeble buds. The root system of the diseased plants was considerably weakened and the aerial parts almost collapsed. This enfeebled condition is considered to be an important factor in the winter killing of lucerne seedlings, commonly encountered in Wisconsin [ibid., vii, p. 786].

The results of field observations and experiments indicate that many other leguminous plants, e.g., clover, soy-beans, garden beans, and the like, are seriously affected by leafhopper feeding, the symptoms being frequently confused with those of mosaic.

The exact nature of 'yellow top' requires further investigation. The symptoms, however, indicate the presence of some infective principle or toxin introduced into the plant tissues with the salivary secretion of the insects.

TASLIM (M.). **Stem-rot of Berseem caused by Rhizoctonia solani Kühn.**—*Agric. Res. Inst., Pusa, Bull.* 180, 8 pp., 2 pl. (1 col.), 1928.

Of the three fungi consistently isolated from the rotted stems of bersim (*Trifolium alexandrinum*) at Pusa, viz., *Rhizoctonia*, *Fusarium*, and *Vermicularia* [*R.A.M.*, vi, p. 208], only the first-named gave positive results in a series of inoculation experiments [details of which are recorded]. The perfect stage of the fungus was not observed, but the morphological agreement between the

bersim parasite and the published descriptions of *R.* [*Corticium*] *solani* is thought to justify its identification as a strain of the latter. The bersim fungus forms numerous sclerotia on glucose and oatmeal agars, and potato slabs. The spread of infection is favoured by a high moisture content of air. The fungus was found to retain its virulence after growing in culture for over a year. Continuous good cultivation and improved drainage of the affected area have brought about a great reduction in the incidence of the disease.

TEHON (L. R.) & STOUT (G. L.). **An Ascomycetous leaf spot of Cowpea.**—*Phytopath.*, xviii, 8, pp. 701–703, 1 fig., 1928.

During 1927 cowpeas (*Vigna sinensis*) in Illinois were observed to be affected by a leaf spot characterized by the development of brown to tan, round or oval lesions, 2 mm. to 4 cm. or more in diameter, the larger ones surrounded by purple-tinted, dark margins of varying width. The average reduction of the healthy leaf surface as a result of this disease in a five-acre field is estimated at 13·5 per cent.

The fungus responsible for the leaf spot was identified as a *Leptosphaerulina* and is named *L. vignae* n. sp., an English diagnosis being given. The light or yellow-brown, spherical to markedly applanate, ostiolate perithecia measure 75 to 100 μ in diameter and bear on the upper half conidiophores producing conidia of an *Alternaria* type; the 4 to 6 (rarely up to 10) aparaphysate asci measure on an average 74 by 25 μ and contain eight brown, biseriate ascospores, 30 to 40 by 12 to 16 μ, with 3 or occasionally 5 transverse septa, one longitudinal septum in the middle cells, and a hyaline, mucilaginous sheath 1·15 μ thick.

VAN POETEREN (N.). **Vragstukken in verband met ziektebestrijding in de fruitteelt.** [Problems in connexion with disease control in fruit cultivation.]—*Tijdschr. over Plantenziekten*, xxxiv, 8, pp. 211–229, 1928.

Some of the outstanding problems connected with the control of fruit diseases in Holland are discussed, with special reference to the work of the Phytopathological Service in propaganda, the testing of disinfectants and apparatus, and the like. Among the diseases enumerated as of special importance are apple and pear scab [*Venturia inaequalis* and *V. pirina*]; canker (*Nectria galligena*); the obscure disease of Star Pippins in Limburg and North Brabant [*R.A.M.*, vii, p. 426]; 'nettle-' or 'parsley-leaf' [reversion] of black currants [ibid., vii, p. 700]; gooseberry mildew [*Sphaerotheca mors-uvae*]; die-back of raspberry canes (associated with various fungi) [ibid., vi, p. 739]; raspberry mosaic; a die-back of young and bearing cherry trees due to *Verticillium* [*alboatrum*: ibid., iv, p. 495] and other causes; and silver leaf of plums (*Stereum purpureum*).

DUTTON (W. C.). **Some effects of spraying materials on trees and fruit.**—*Thirty-fourth Ann. Rept. Quebec Pomol. and Fruit Growing Soc., 1927*, pp. 14–27, 1928.

A full account is given of numerous spraying and dusting experi-

ments conducted throughout several seasons on apple and cherry trees in Michigan, with special reference to the physiological effects of the applications on the trees and fruit. The results [which are tabulated and discussed in detail] showed that Morello and Montmorency cherries were very adversely affected both in size (producing the condition sometimes termed 'small cherry') [*R.A.M.*, vi, p. 426] and quality when the trees were sprayed with Bordeaux mixture, though lime-sulphur caused less trouble and sulphur and copper-lime dusts still less. It was also found that excessive spraying of Baldwin, McIntosh, Jonathan, and Hubbardston apple trees with lime-sulphur may cause an abnormal drop of the fruit, but it is considered that a reasonable spraying programme should not usually produce this effect under Michigan conditions. Foliage spray-injury on apple trees may check the formation of fruit buds, especially if repeated year after year.

A series of experiments to determine the effect of different strengths of materials and rates of application on apple trees and on the intensity of infection with scab [*Venturia inaequalis*] is also described and discussed [ibid., vi, p. 36].

MARTIN (W. H.) & CLARK (E. S.). **Apple scab studies.**—*Forty-eighth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1927*, pp. 218–221, 1928.

Apple leaves bearing perithecia were placed in chambers at temperatures of 40°, 50°, 75°, 84°, and 95° F. and examined at weekly intervals for ascospore development. The ascospores were found to develop early and profusely, and to be discharged at both 40° and 50° [*R.A.M.*, vii, p. 451], but not at the higher temperatures. No asci developed at 84° or 95°.

Under natural conditions in the orchard the first ascospores were discharged at New Brunswick before 5th May and the process was still continuing on 27th June, when the work was discontinued. The heaviest discharge occurred just before and after the 17-day spray on 14th June. In most cases the periods of heavy discharge immediately followed rain. At Bridgeton a very light discharge was observed on 1st to 2nd May, and from 16th to 17th May till 30th June heavy discharges occurred during or after rain. It was found that very little infection had taken place before the calyx spray on 13th May, but at the time of the four-weeks application (14th June) the incidence of scab on Stayman, Winesap, and Paragon leaves amounted to 54·2, 47·2, and 65·6 per cent., respectively. On 17th September about 96 per cent. of the foliage on unsprayed trees of these varieties was scabbed.

BUTLER (O.) & DORAN (W. L.). **Spray solutions and the control of Apple scab.**—*New Hampshire Agric. Exper. Stat. Tech. Bull.* 36, 15 pp., 1 graph, 1928.

In this paper the writers describe investigations on the toxicity of lead arsenate, lime arsenate, and lime-sulphur solution (alone and in combination with the arsenicals mentioned) to the conidia of *Venturia inaequalis*, and the control of apple scab given by these preparations in orchard spraying [*R.A.M.*, iv, p. 675]. A

study was also made of the effect on the tree of the lead and lime arsenates, alone and in combination with lime-sulphur.

The results of the investigations [which are tabulated] showed that lead arsenate is not completely toxic at the concentrations ordinarily employed, the number of conidia germinating at 1, 0·5, and 0·25 per cent. being 3, 6, and 13 per cent., respectively. In an experiment to determine the relative toxicity of the acid and basic arsenates of lead, the latter was found to be less toxic than the former at all strengths, the difference being very considerable at the usual spraying concentration of 0·5 per cent. (22 per cent. of conidial germination allowed by the basic compared with 3 per cent. by the acid). The corresponding figures for conidial germination at concentrations of 1 and 2 per cent., respectively, were 35 and 7 per cent. for the basic arsenate, while the acid completely inhibited germination at both strengths. Field experiments have shown that, in cases of severe scab infestation, even the acid lead arsenate (which predominates among the commercial brands) does not afford adequate protection.

In a series of spraying experiments conducted by Morse and Folsom in Maine [ibid., v, p. 369], a much higher degree of protection against scab was afforded by lime arsenate (2 lb. in 50 galls.) than by lead arsenate (3·7 times better than no spraying as compared with 1·9 times).

When lime-sulphur solution is sprayed on a plant the wash decomposes rapidly [ibid., ii, p. 281]. Under conditions favouring conidial germination in *V. inaequalis* lime-sulphur is only very slightly toxic at the concentrations used in orchard spraying after the sulphides have disappeared. In the writers' tests 70 per cent. of the conidia germinated in lime-sulphur containing no sulphides at the 1 in 40 and 1 in 80 concentrations, compared with 75 per cent. in distilled water.

The addition of lead arsenate to lime-sulphur solutions was found greatly to increase their toxicity: thus, conidial germination was reduced from 70 to 5 and 3 per cent., respectively, by adding 0·37 per cent. lead arsenate to the 1 in 80 and 1 in 40 lime-sulphur solutions, and from 36 to 0 per cent. by adding the same quantity of lead arsenate to the 1 in 20 lime-sulphur solution. A marked increase of toxicity was further obtained by the addition of arsenious oxide (0·0012 to 0·02 per cent.) to the 1 in 40 lime-sulphur solution, conidial germination being reduced from 70 to 22 per cent. by the former quantity and to 0 per cent. by the latter. It was shown by a comparative test that, whereas the addition of 0·25 per cent. lime arsenate increases the toxicity of the lime-sulphur solution between 1·56 and 1·75 times, an admixture of lead arsenate increases it between 14 and 23 times.

From 1923 to 1927, inclusive, the writers have used the following schedule for the control of scab on McIntosh apples: lime-sulphur 1 in 50 plus 1·5 lb. lime arsenate per 50 galls. for the pre-pink and calyx sprays, and lime-sulphur 1 in 50 for the pink spray and the post-calyx application. The incidence of infection was reduced to a negligible amount in every year except 1927, when it reached 27·1 per cent. compared with 86·8 per cent. in the unsprayed controls.

The addition of lead arsenate to the lime-sulphur solution caused some russeting of the fruit, which was almost entirely absent where lime arsenate was used.

Spraying and dusting recommendations for Apples.—*New Jersey Agric. Exper. Stat. Circ.* 209, 4 pp., 1 fig., 1928.

The following schedule is designed to meet the average conditions obtaining in New Jersey apple orchards [*R.A.M.*, vi, p. 670]. (1) Delayed dormant application for scab [*Venturia inaequalis*] and insects: commercial concentrated lime-sulphur solution, 10 galls. to 90 galls. of water, plus 40 per cent. nicotine ($1\frac{1}{2}$ pints per 100 galls.). (2) and (3) Pre-pink and pink bud: lime-sulphur (10 qts. to 100 galls. of water), plus powdered lead arsenate or its equivalent as paste (3 lb. per 100 galls.). (4) Petal fall: New Jersey dry-mix sulphur-lime [ibid., v, p. 311], 25 lb. per 100 galls. of water, plus lead arsenate as above, or concentrated lime-sulphur, 10 qts. per 100 galls. of water, where the fruit is not liable to burning or russeting. (5) and (6) Seven and 17 days after petal fall: as under (4). Some special recommendations for treatment are also given.

Paynter (L.). **Bordeaux and lime-sulphur sprays. Comparative test in Canterbury Orchard.**—*New Zealand Journ. of Agric.*, xxxvii, 2, pp. 124–126, 1928.

In a spraying experiment [full details of which are given] conducted near Christchurch, New Zealand, the foliage of Delicious apple trees sprayed with Bordeaux mixture and oil was at first much superior to that of other Delicious trees sprayed with lime-sulphur, but by the end of January, owing to insect attack, the former were fully 30 per cent. inferior. Bordeaux mixture did not give better control of black spot [*Venturia inaequalis*] than did lime-sulphur; infection was, however, slight even on the control trees. Sturmers sprayed with Bordeaux mixture were smaller and much more russeted than those treated with lime-sulphur, but with Delicious apples no difference was detected.

Martin (W. H.). **Apple blotch control studies.**—*Forty-eighth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1927,* pp. 216–218, 1928.

The results of experiments [details of which are given] to determine the comparative efficacy of commercial concentrated lime-sulphur and Bordeaux mixture for the control of apple blotch [*Phyllosticta solitaria*] clearly showed the superiority of the latter preparation [cf. *R.A.M.*, v, p. 472; vii, p. 451]. On the blocks sprayed with lime-sulphur throughout the season only 45·1 per cent. of the crop was clean, compared with 70·4 per cent. where 2–4–50 Bordeaux mixture was used at the last two applications (17th June and 26th July).

McLarty (H. R.). **Some observations on physiological diseases in Apple in British Columbia.**—*Scient. Agric.*, viii, 10, pp. 636–650, 6 figs., 2 graphs, 1928.

Since 1922 the writer has been engaged on a study of three

physiological diseases, namely, die-back, drought spot, and corky core [*R.A.M.*, iii, p. 655; v, p. 147; vii, p. 328], which cause very heavy economic losses in the Okanagan (British Columbia) apple crop. Die-back is characterized by the apparent inability of the trees to produce buds normally on the previous year's growth, or by the formation of sickly clusters of leaves which soon shrivel and die. Drought spot refers to a condition of the fruit resulting from the death of the epidermal layers at a time when the apple has just passed the blossoming period. Corky core is the name used to describe the development of light brown spots of dead corky tissue in the core region, sometimes involving the whole flesh of the fruit.

These three types of disease appear to be associated in some way, susceptible trees tending to show now one form and now another, while sometimes two or all three conditions may occur simultaneously. No trace of any parasitic organism could be found in the affected tissues, thereby confirming previous conclusions as to the purely physiological nature of the trouble. Investigations were accordingly conducted to ascertain the influence of cultural conditions on the incidence of the diseases, and to compare the factors affecting growth in healthy and diseased orchards, respectively.

The results of five years' experiments showed that, at any rate in the Salmon Arm district, the use of a vetch cover crop, coupled with the provision of sufficient water to prevent injury from drought, gave excellent control of corky core.

The diseases were found to occur on soils of varying depth and of all kinds. They were more prevalent, however, on shallow, poorly drained, silt, gravel, sand, or clay soils, especially when in poor physical condition. In general, a good humus content in soils of reasonable depth appears to afford protection from the diseases in question. An enhanced susceptibility was observed in orchards where the trees show signs of suffering from drought in the late summer or autumn, and also in those where waterlogging occurs during the same period. No correlation was found between these physiological diseases and the vigour, age, and productivity of the trees, the colour and texture of the fruit, pruning methods, or winter injury. Corky core was not found to develop in storage tests during three years, and the apples affected by this condition showed no sign of increased susceptibility to breakdown or storage rots. The McIntosh, Wealthy, Jonathan, and Rome Beauty varieties are the most severely affected, in the order named.

A comparative study of the root development of healthy and diseased trees showed that the occurrence of these conditions in a given season was preceded, in the previous year, by an excessive killing-off of the root hairs and succulent rootlets at a time when the soil moisture content approaches the wilting coefficient. A similar loss of the feeding roots was found to result when the trees were suddenly exposed to waterlogging. This killing of the rootlets is believed to result in a loss of balance in the manufacture of food in the tissues of the tree or at least in the limb above the affected area. This unbalanced food supply further induces certain fundamental modifications in the protoplasm of the cells of the

developing buds which are subsequently expressed in the conditions described above.

CAMPBELL (J. A.). **Cracking of Dunn's and Cox's Orange Apples. Investigation in Nelson District.**—*New Zealand Journ. of Agric.*. xxxvii, 2, pp. 85–86, 1928.

Of recent years much loss has been occasioned in parts of New Zealand through the russeting and excessive cracking of certain varieties of apples, particularly Dunn's and Cox's Orange, a condition which appeared to grow worse annually in the Nelson district. Much improvement was, however, observed in 1928, where growers had thoroughly cultivated and manured the land, and adopted heavier pruning. From replies to a questionnaire, it appears that 19 out of 21 growers who experienced cracking considered that the trouble was physiological in origin and could be controlled by hard pruning and improved cultivation.

HARTMAN (H.), ROBINSON (R. H.), & ZELLER (S. M.). **The removal of spray residue from Apples and Pears.**—*Oregon Agric. Exper. Stat. Bull.* 234, 38 pp., 3 figs., 1928.

In the course of a discussion on the removal of arsenical spray residues, attention is drawn to different forms of injury to apples and pears resulting from cleansing the fruit by mechanical and chemical means.

Wiping and brushing pears frequently leads to the development of blue mould [*Penicillium* spp.: see next abstract], the fungus causing the so-called 'pinhole rot'. Winter Nelis, Comice, and Anjou are all liable to injury from this cause.

According to the past two seasons' data, moisture on the fruit at packing time has not increased the amount of decay. The incidence of blue mould was 2·2 per cent. in dry fruit and 1·7 in wet, while that of perennial canker [*Gloeosporium perennans*] and anthracnose [*Neofabraea malicorticis*] together was 3·4 per cent. in dry and 3·9 per cent. in fruit packed wet.

Injury from core penetration by washing solutions in which the fruit is completely immersed may be manifested in various ways. In mild cases of acid penetration a discoloration of the calyx tube and the walls of the seed-cavities is evident, while in serious ones blue mould usually develops soon after treatment. Decay does not, as a rule, follow formaldehyde penetration, but may do so where this substance is combined with hydrochloric acid. Considerable injury is caused by the penetration of strong basic compounds, e.g., sodium hydroxide, and decay frequently results. But with proper precautions the washing process does not cause sufficient injury to prevent its continued use and appears even to reduce some forms of decay. Washing should be carried out immediately after picking.

The so-called 'calyx end rot' of apples observed in Oregon of recent years seems to be a combination of arsenic injury and rotting by the above-mentioned organisms.

HEALD (F. D.), NELLER (J. R.), OVERLEY (F. L.), RUEHLE (G. D.), & LUCE (W. A.). **Arsenical spray residue and its removal from Apples and Pears.**—*Washington Agric. Exper. Stat. Bull.* 226, 100 pp., 14 figs., 2 diags., 1928.

Arsenical calyx burn of apples [see preceding abstract] was found, in the course of extensive investigations on different aspects of the spray residue problem, to be particularly severe on Jonathans treated with acid process washing machines fitted with a driving or jet spray. The submersion and alkali ('brogdite-brogdex') processes were also injurious. Calyx burns were shown to serve as entrance channels for various rot-producing fungi, e. g., blue moulds (*Penicillium* spp., especially *P. expansum*); grey moulds (*Botrytis, Fusarium, Pestalozzia*, and *Rhizopus* spp.); black rots (*Alternaria, Stemphylium, Pleospora, Cladosporium*, and *Phomopsis*) [*R.A.M.*, vii, pp. 363, 789]; and anthracnoses [*Neofabraea malicorticis* and *Gloeosporium perennans*].

Accumulation of fungus spores in the cleaning and rinsing baths may amount to 12,000 per c.c. per diem in the case of blue mould. This number may be greatly reduced by excluding partially decayed apples from the machine; by a pre-wash; by frequent changes of the acid bath; by a continuous spray of fresh water for rinsing; by sterilization of the bath overnight; and by the use of a fungicide.

The percentage of decay in the authors' tests varied from 0·5 in the untreated controls to from 0·67 to 3.19 in fruit treated by the wet process machines (four varieties and seven machines), and a range from 0.17 to 0·99 in the dry brushing processes.

Open calyx canals afford ingress to rot-producing fungi, leading to the development of core rots, especially when the fruit is washed by submersion.

The brogdite-brogdex process of removing spray residues (borax 8 oz., soda ash 2 oz., caustic soda 1 oz. per gall. of water heated to 105° to 110° F., the machine supplied by Northwest Brogdex Co., Yakima, Washington) failed to control blue mould or perennial canker, but it almost completely prevented soft scald in Jonathans.

KIDD (F.). **Cold storage of fruit.**—*New Zealand Journ. of Sci. and Techn.*, x, 2, pp. 80-89, 1928.

In this paper the writer discusses his observations on the application of scientific research to the storage, handling, and transport of New Zealand fruit under the following headings: temperature of storage; humidity, air-movement, and ventilation of cold stores; general conclusions as to the effect on the fruit of physical conditions of storage; control of physical conditions and instruments; mechanical efficiency of stores and economy in running; overseas shipments of fruit; and further researches likely to prove valuable to the fruit industry.

BARKER (J.). **Wastage in Australian fruit exported to England.**—*Journ. Australia Council Sci. & Indus. Res.*, i, 5, pp. 261–267, 1928.

During 1927 systematic examination of the condition of Aus-

tralian fruit upon its arrival at the London docks showed that wastage in apples was chiefly due to bitter pit [*R.A.M.*, vii, p. 102] and, to a less extent, to internal breakdown [ibid., vi, p. 623]; in Tasmanian Cox's Orange Pippin, Cleopatra, Ribston, and Sturmer Pippin apples, bitter pit affected 21, 10, 9, and 9 per cent., respectively, and in Western Australian Cleopatra apples 18 per cent. Internal breakdown was less extensive when the fruit arrived at the docks, but owing to the rapidity of its subsequent development may ultimately cause even greater loss; the most susceptible varieties include Jonathan from Tasmania and Western Australia, and Tasmanian Cox's Orange and Ribston Pippins. The data obtained agree on the whole with the accepted view that bitter pit is much more extensive in early than in late shipments, and that both bitter pit and internal breakdown are most severe in the larger apples. There was some indication that internal breakdown increases in the later shipments and is commoner in apples which are yellow on arrival than in less ripe fruit. Wastage due to fungal rotting was less than one per cent. for all varieties and was mainly due to mould following accidental injury. Jonathan spot [ibid., iv, p. 676] was present on Western Australian and Tasmanian Jonathans, but reached significant proportions (9 per cent.) only in the former.

Observations of the rate of development of internal breakdown during distribution subsequent to unloading, made on apples chosen as showing only slight breakdown on arrival at market, indicated that deterioration was surprisingly rapid, increasing in some cases from under 1 to over 30 per cent. in two or three weeks. Bitter pit was found to become more prominent after apples reached the market, but did not appear on fruit which was unaffected on arrival there.

The losses in pears were mainly due to over-ripeness; they were very heavy in 1926, but less so in 1927.

In general, Ohanez grapes were sound on reaching the market, but the other Western Australian varieties Black Malaga, Wortley Hall, Red Punce Colmar, Tehai, and Purple Cornichon suffered severely from 'dropping', i. e., the separation of the berries from the stalks. The cause of this is unknown, though in South African grapes it is believed to be worst in the more mature fruit. The only consignment from New South Wales (Ohanez variety) was severely damaged, apparently by a species of *Penicillium* attacking the base of the grapes.

GOODWIN (W.), SALMON (E. S.), & WARE (W. M.). **The spraying of Cherry orchards against 'leaf-scorch'.**—*Journ. South-Eastern Agric. Coll., Wye, Kent*, 25, pp. 147–151, 2 figs., 1928.

In 1927 tests were conducted in Kent in which 75 large Early Amber, Waterloo, Amber, Victoria Black, Rivers, and Frogmore cherry trees, some of 30 to 40 ft. in height, affected with leaf scorch (*Gnomonia erythrostoma*) [*R.A.M.*, v, p. 615] and bearing numerous dead leaves were sprayed with Bordeaux mixture 8–8–100 plus 4 lb. lead arsenate paste per 100 galls. of mixture by means of Armada spray guns [which are described: ibid., vi, p. 117]. Other trees of

the same varieties showing a similar degree of infection were left unsprayed as controls.

A first application of about 5 galls. per tree was made on some of the trees on 12th April, to protect the young foliage. On 10th May, a second application was made to the same trees and the remainder were sprayed for the first time, each tree receiving 6 to 7 galls. of the mixture.

No disease appeared even on the control trees, no doubt because the seasonal conditions in 1927 were unfavourable to its development, so that the tests only showed that the methods used were effective in covering most of the foliage even of the large trees with a good film of the mixture without appreciable injury to any of the varieties.

BRADFORD (F. C.). **Cherry trees defoliated by leaf spot. Future fruit crops threatened by failure of trees to store food.**—*Quart. Bull. Michigan Agric. Exper. Stat.*, xi, 1, p. 7, 1928.

During the summer of 1928 Michigan sour cherry orchards were very severely affected by an epidemic of leaf spot [*Coccomyces hiemalis*], which, it is feared, will have interfered with the storage of reserve food in the trees. The measures recommended consisted in light pruning and heavy fertilizing to favour foliage development and bring the trees into condition for the 1930 crop.

COLBY (A. S.). **The inheritance of anthracnose resistance in certain Raspberry hybrids.**—*Journ. of Heredity*, xix, 8, pp. 377–382, 2 figs., 1928.

In connexion with his work of breeding black raspberries [*Rubus occidentalis*] resistant to anthracnose [*Plectodiscella veneta*] in Illinois [*R.A.M.*, vi, p. 566], the writer states that some 1200 seedlings selected during 1922–3 have now fruited. In 1926 and 1927 studies were made on the resistance of the parent plants as well as the seedlings in the different progenies. The results of these investigations [which are described and tabulated] showed that some of the F_1 seedlings were more resistant than the parents: this was particularly noticeable in the case of Quillen, which was surpassed by 30 per cent. of its progeny in respect of freedom from disease. A number of promising individuals in each progeny were found to combine anthracnose resistance with various other desirable qualities, the percentage of such seedlings ranging from 9 in the Royal variety to 30 in Quillen. It has been observed that when the fairly susceptible Plum Farmer is used as the pistillate parent, resistance to anthracnose is more frequent in the progeny than when it is used as the pollen parent.

TRYON (H.). **Pineapple disease investigations. Interim report.**—*Queensland Agric. Journ.*, xxx, 1, pp. 26–34, 1928.

In this report notes are given on the symptoms, causes, and control of various diseases of pineapples in Queensland.

Top rot, in which the apical growth undergoes a form of wet decay, is associated with a rotting of the feeding roots in badly drained soils. In base rot, the leaves turn yellowish from the base of the plant upwards and die, the plant gradually ceasing to bear

fruit. This condition is due to decay spreading from the point where the sucker has been detached, or from the abortive pineapple at the base of a 'gill sprout'. In chlorosis, normal growth is arrested and the plant is pale or whitish instead of green. The Queensland form is regarded as different from those prevailing in the West Indies and Hawaii [*R.A.M.*, v, p. 326], and is attributed to defective drainage. Tangle root [ibid., v, p. 716] results from the inability of the roots to reach the soil owing to the leaf sheaths failing to decay. The condition is common where the basal leaves have not been removed from the suckers before planting, or where the latter have been planted in a flat, dry soil. Two types of pineapple wilt are distinguished: in one the sucker and older leaves curve over, and the young foliage is a vivid green, though the outer leaves may be yellowish. The leaves are short, with involute margins, and usually are turgid and brittle. The plant is stunted and frequently bears no fruit. The second form of wilt generally occurs on poor soils; the stem curves over, the foliage is pale and loses its turgidity, and the lower leaves and stem decay, though the roots apparently remain healthy.

A sterile white soil fungus sometimes attacks the leaf sheaths at the base of the stem, causing the leaves to turn yellow; later, the corm decays, the affected tissue becoming powdery.

Fruitlet core rot [ibid., vii, p. 794] is very prevalent in south Queensland during winter, sometimes affecting 25 per cent. of the fruit. In rough-leaf pines the disease originates in mite (*Tarsonemus*) injuries at the base of the closed calyx cavity, or sometimes (especially in smooth leaf varieties) in fissures in the same place when changes in temperature cause the tissue to crack. Fungous invasion takes place through the wounds thus produced.

In 1918 a local winter crop on neglected land developed a watery condition of the core, the change extending outwards to the surface. The cause of this condition is unknown.

CATHCART (C. S.) & WILLIS (R. L.). **Analyses of materials sold as insecticides and fungicides during 1927.**—*New Jersey Exper. Stat. Bull.* 459, 16 pp., 1927. [Received November, 1928.]

This bulletin presents the results of the examination of 137 samples of insecticides and fungicides collected for inspection during 1927 [*R.A.M.*, vi, p. 498].

Eight proprietary brands of Bordeaux mixture were examined for their copper content, namely: (1) dry Bordeaux mixture (Ansbacher Insecticide Co., Inc., New York), containing 16·27 per cent. metallic copper. (2) Chipman Brand Bordeaux mixture (Chipman Chemical Engineering Co., Inc., Bound Brook, N.J.), 11·50 per cent. (3) Key Brand Bordeaux mixture (Interstate Chemical Co., Jersey City, N.J.), 14·58 per cent. (3) Green Cross dry Bordeaux mixture and (5) Green Cross dry Bordo (Lucas-Kil-Tone Co., Vineland, N.J.), 21·28 and 25·44 per cent., respectively. (6) Bordeaux mixture (Mechling Bros. Chemical Co., Camden, N.J.), 12·73 per cent. (7) Bordeaux mixture (Nitrate Agencies Co., Bayonne, N.J.), 14·14 per cent. (8) Fungi Bordo (Sherwin-Williams Co., Cleveland, Ohio), 12·10 per cent.

Batelle and Rennick, New York, supply a guaranteed 99½ per cent. pure superfine commercial sulphur which actually contained 99·70 per cent. total sulphur. Mechling Bros.' sulphur dust had a total sulphur content of 99·50 per cent.

The sulphur content of the following mixtures was determined: (1) New Jersey dry-mix sulphur-lime (J. R. Gillam and Bro., Burlington, N.J.), 55·58 per cent. total sulphur. (2) and (3) Two brands of sulpho-tone, (4) and (5) 80–20 sulphur-lime dust and sulphur-lime mixture (Lucas-Kil-Tone Co.), 59·59, 65·37, 76·49, and 77·48 per cent., respectively. (6) and (7) Two brands of Mechling's dry-mix (Mechling Bros.), 58·46 and 63·39 per cent. (8) Kasulime (Nitrate Agencies Co.), 49·82 per cent. (9) and (10) Two brands of Niagara kolodust, (11) and (12) two brands of Niagara koloform, and (13) Niagara dry-mix, 97·68, 97·19, 71·26, 70·95, and 59·46 per cent., respectively. Seven lime-sulphur solutions were also examined for their sulphur content.

Analyses of a number of other miscellaneous fungicides are given.

WORSLEY (R. R. Le G.). **Bordeaux mixture. Its adhesive power under Egyptian climatic conditions.**—*Min. of Agric., Egypt, Tech. and Sci. Service (Chem. Sect.) Bull.* 78, 5 pp., 1928.

A series of experiments [which are described and the results tabulated] was conducted in the laboratory and on citrus trees in the open to determine the best proportions for Bordeaux mixture in order to secure adhesiveness under Egyptian conditions. The most suitable ratio of the copper sulphate, lime, and water was found to be 1:0·5:50 or 100, the mixture being prepared at a temperature between 15° and 30° C. (preferably as near 20° as possible).

Kennzeichnung der vom Deutschen Pflanzenschutzdienst erprobten Pflanzenschutzmittel. [Marking of the plant protectives approved by the German Plant Protection Service.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst,* viii, 8, pp. 78–79, 1928.

In an announcement issued by the Director of the Biological Institute of Agriculture and Forestry (Berlin) on 19th May, 1928, permission is granted to the manufacturers of plant protectives officially approved by the German Plant Protection Service to affix certain distinguishing marks to the wrappings of their preparations. These include, in addition to the name of the preparation, the initials D.P.D., the date of the last list of approved plant protectives issued by the Service, and the patented device of the Biological Institute (consisting of a serpent entwined round an ear of corn).

PEGLION (V.). **Le malattie crittogamiche delle piante coltivate. 5a Edizione.** [Cryptogamic diseases of cultivated plants. 5th edition.]—Casale Monferrato, F-lli Ottavi, 1928. [From a review in *Boll. R. Staz. Pat. Veg.*, N.S., viii, 2, p. 226, 1928.]

This book, which is written from a practical point of view,

makes frequent reference to the relations between various fungous diseases and environment, and stresses the close connexion which should exist between phytopathological research and practical agriculture. The present edition has been carefully revised, and contains the most recent information, particularly in regard to potato diseases.

OGILVIE (L.). **Virus diseases of plants in Bermuda.**—*Agric. Bull. Bermuda Dept. of Agric.*, vii, 8, pp. 4–7, 1928.

A list is given of the mosaic and allied diseases of plants hitherto observed in Bermuda. In addition to items already noticed in this review from the author's reports, and common, widely distributed virus diseases, the following are of interest. Both string and broad beans (*Phaseolus vulgaris* and *Vicia faba*) are commonly and destructively affected by mosaic. *Canavalia lineata* [*C. obtusifolia*] mosaic has also been observed, and sweet pea mosaic is common.

Narcissus tazetta plants not infrequently show a certain amount of stunting and mottling of the leaves due to mosaic.

Wild and garden radishes (*Raphanus raphanistrum* and *R. sativus*) are affected by a mosaic disease causing distortion of the leaves, often with the production of blister-like areas.

PETRI (L.). **L'omotallismo e l'eterotallismo sessuale dei funghi in rapporto alla patologia vegetale.** [The sexual homothallism and heterothallism of fungi in relation to plant pathology.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 2, pp. 123–162, 3 figs., 9 diags., 1928.

In this paper the author reviews and discusses in some detail the results of recent investigations by various workers into heterothallism in fungi, the bearing of the facts upon certain aspects of phytopathology being emphasized.

SIBILIA (C.). **Influenza di estratti fungini sopra la fruttificazione di funghi parassiti.** [The influence of fungal extracts upon the fructification of parasitic fungi.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 2, pp. 174–180, 1928.

After referring to previous investigations upon the stimulation of fungal growth by extracts of other fungi [cf. *R.A.M.*, vii, p. 388], the author describes experiments in which cultures of *Rosellinia necatrix*, *Microcera coccophila*, *Gloeosporium cyclaminis*, *Diplodia laelio-cattleyae*, and *Sphaeropsis malorum* [*Physalospora cydoniae*] were treated with an extract of, or grown in mixed cultures with, a strain of *Penicillium glaucum*.

Perithecia were not formed, but the *Penicillium* extract markedly stimulated the conidial fructification of *M. coccophila*; conidia, however, were not produced when *M. coccophila* was grown in mixed cultures with the *Penicillium* strain. The vegetative development of *G. cyclaminis* was markedly stimulated by the *Penicillium* extract, with abundant production of acervuli. Mixed cultures of *G. cyclaminis* and the *Penicillium* strain showed no difference from the controls. No stimulation of the vegetative

development of *R. necatrix* was observed, and no pycnidia were produced in the cultures of *D. laelio-cattleyae*. The development of *S. malorum* was very sparse in the controls, but vigorous in the series treated with the *Penicillium* extract, though there was no formation of pycnidia.

VAN LUIJK (A.). **Variationsstatistische Untersuchungen an Ustilagineen.** [Investigations on the statistics of variation in the Ustilagineae.]—*Meded. Phytopath. Lab. 'Willie Commelin Scholten', Baarn (Holland)*, xii, pp. 36–52, 1 graph, 1928.

The rule that variations in spore dimensions amounting to less than three times the probable error of calculation should not constitute a specific difference, is only applicable, in the writer's opinion, to cases in which the material for investigation is grown under exactly comparable external conditions. This formula is not reliable for the determination of fresh or desiccated material on the natural substratum. In a series of comparative investigations with *Tilletia tritici* [details of which are given], satisfactory results as regards the mean values of the length, width, and size index were given by taking $\sigma/\sqrt[4]{N}$ instead of $\sigma/\sqrt[2]{N}$ as the probable error. In no case was a larger difference than $6 \times \sigma/\sqrt[4]{N}$ found between individuals of genetically identical material and as a rule the difference did not exceed $3 \times \sigma/\sqrt[4]{N}$.

Wart disease of Potatoes.—*Min. of Agric. Leaflet* 105, 10 pp., 2 pl., rewritten May, 1928.

A popular account is given of the history, distribution (especially in England), symptoms, etiology, and mode of dissemination of potato wart (*Synchytrium endobioticum*), together with notes on the actual and potential losses from the disease and on varietal reaction to the attacks of the fungus. The main requirements of the English Wart Disease of Potatoes Order of 1923 [*R.A.M.*, ii, p. 591] are also recapitulated.

LINDFORS (T.). **Potatiskräfta i landet!** [Potato wart in the country!]—*Landtmannen*, xi, 34, pp. 676–677, 1 fig., 1928.

Notwithstanding the stringent regulations to prevent the introduction of potato wart [*Synchytrium endobioticum*] into Sweden [*R.A.M.*, vii, p. 595], the discovery of this disease was reported about the middle of August, 1928, from two widely separated localities, one in Skåne and the other in Södermanland. It is conjectured that infection has probably been present in a dormant form since the war period, when large quantities of potatoes were imported from Germany. Some general directions are given for the prevention of further spread and for the use of immune varieties.

[In a leaflet (*Flygblad* 133 of the Centralanstalten för Jordbruksförsök) the author briefly summarizes the symptoms and mode of dissemination of potato wart. A Royal Decree of 6th September, 1928 (effective as from 12th September) defines the regulations to be adopted for the control of the disease.]

KÖCK [G.]. **Ein neues Krebsvorkommen in Steiermark.** [A new case of wart disease in Styria.]—*Oesterr. Zeitschr. für Kartoffelbau, 1928*, 3, pp. 70–71, 1928.

Potato wart [*Synchytrium endobioticum*] was detected early in August, 1928, in a fresh locality (Kapsenberg) of Styria [*R.A.M.*, vii, p. 815]. The affected plots are situated in the allotments belonging to the employees of a neighbouring steel works. The disease is particularly severe on plots receiving applications of liquid manure. Stringent measures have been adopted to arrest the spread of infection.

HAUSMANN (O. P.). **Die Kultur der Kartoffel im holländischen Friesland.** [Potato cultivation in Dutch Friesland.]—*Oesterr. Zeitschr. für Kartoffelbau, 1928*, 2, pp. 17–31; 3, pp. 49–68, 4 pl., 1 graph, 1928.

In addition to many other interesting items of information on the subject of potato cultivation in Dutch Friesland, this paper contains some observations on the control of the diseases of the crop. The carefully selected seed-tubers are immersed in 1 per cent. corrosive sublimate, primarily for the prevention of *Rhizoctonia* [*Corticium*] *solani*. This practice has become part of the general routine, and immense numbers of sublimate tablets (223,000 in the winter of 1924–5) are sold annually for the purpose. The virus diseases and potato wart [*Synchytrium endobioticum*] are much less prevalent in Friesland than elsewhere; these diseases are adequately combated by mass selection according to approved methods [which are described]. Late blight (*Phytophthora infestans*) is widespread, and three to ten applications of Bordeaux mixture are given for its prevention in July and August.

VAN BEYMA THOE KINGMA (F. H.). **Ueber ein Kartoffelfäule verursachendes Verticillium, Verticillium foëxii nov. spec.** [On a *Verticillium* causing Potato rot, *Verticillium foëxii* n. sp.]—*Meded. Phytopath. Lab. 'Willie Commelin Scholten', Baarn (Holland)*, xii, pp. 31–35, 3 figs., 1928.

The specific identification of the *Verticillium* isolated by Foëx from rotting potato tubers in France and described in 1923 [*R.A.M.*, iii, p. 296] having been entrusted to the 'Centraalbureau', the author made a morphological and cultural study of this fungus, which is considered to be a new species and named *V. foëxii* [a diagnosis being given in German].

The fungus forms a luxuriant, pale pink mycelium on beerwort, carrot, maize seeds, and hyacinth and tulip bulbs. The fertile hyphae often form coremiate fascicles up to 1 cm. in height. The erect conidiophores, mostly light brown at the base, measure 100 to 300 μ in height (average 200 μ) and 5 to 6 μ in width. The primary branches are 20 to 70 μ long (average 40 μ), opposed or verticillate and with 5 or 6 branches at the tip, which in their turn are often di- or trichotomously branched, each of these branches having 3 to 6 whorls of terminal branchlets ['phialids']. These terminal ramifications are elongated-lageniform, 33 to 43 μ long and 2·3 μ thick at the base, hyaline, tapering to a point, generally

running parallel to the conidiophore, and resembling a *Penicillium* in their arrangement.

The elongated-spherical to irregularly ellipsoid or bean-shaped, hyaline conidia, often tapering to a fine point at one end, and having 1 or 2 (occasionally 3 or 4) oil drops, are formed singly but may remain grouped in heads of 7 to 20 μ at the tips of the branches. They measure 5 to 10 by 2·7 to 4 (mostly 5·7 to 7 by 3 to 3·3 μ).

A species of *Verticillium* isolated from narcissus bulbs in Kansas in 1925 has also been identified as *V. foëxii*.

MOORE (H. C.) & WHEELER (E. J.). **Further studies of Potato hollow heart. Proper cultural practices lessen percentage of tubers affected.**—*Quart. Bull. Michigan Agric. Exper. Stat.*, xi, i, pp. 20–24, 1928.

In further investigations [details of which are given] into hollow heart of potatoes [*R.A.M.*, vi, p. 688], conducted during 1927 at the Michigan State College, certified Russet Rural potatoes were planted in June in soil in which a three-year-old lucerne crop had been ploughed under a few months earlier, and which had also received dressings of nitrogen, phosphorus, and potash applied separately and in combination, some plots being left without fertilizers as controls. All the treated plots gave a higher yield than the untreated controls, except those receiving nitrogen only. The highest percentage of hollow heart (12·43 per cent. by weight) was found in the plots which received the potash fertilizer only; those receiving nitrogen with phosphorus and the complete 3 – 4 – 12 nitrogen-potash-phosphorus fertilizers showed 2·61 per cent. and no infection, respectively.

Irrigation during August (3·41 in., with 0·21 in. rainfall, making 0·78 in. above normal) increased the yield by 121·62 bushels per acre, and hollow heart by 6·77 per cent. Hills in irrigated plots averaged 0·54 more stalks, 1·76 more tubers weighing 0·96 lb. more, and 4·26 per cent. more hollow heart than did hills in unirrigated plots. Observations up to date indicate that hollow heart of Russet Rural potatoes under Michigan conditions is likely to be serious unless the August rainfall is below normal.

When the hills were spaced 36 by 18 inches apart, which is the maximum now recommended for this variety in good soil, the plots gave an average of 0·44 more stalks per plant, 61·3 more bushels per acre of No. 1 grade, 10·04 more bushels per acre of No. 2, and 5·43 per cent. less hollow heart than when the hills were spaced 36 by 36 inches.

When two seed-pieces (average 2 ounces each) were planted per hill the plots gave an average increase in tubers of 0·35 lb. per hill with 3·29 per cent. less hollow heart, compared with plots planted with one seed-piece. Seed-pieces weighing two ounces gave an average of 1·22 more stalks per hill, 8·08 per cent. less hollow heart, and 0·37 lb. more tubers than those weighing one ounce, while the corresponding figures for three-ounce as against two-ounce seed-pieces were 0·97, 5·74, and 0·38, respectively.

Hills planted with tubers from apparently healthy plants

averaged 1·52 more stalks and 1·24 more tubers weighing 0·07 lb. more than did hills with tubers from plants suffering from the giant hill disease [ibid., v, p. 179]. The latter also showed 16·9 per cent. hollow heart, as compared with none in the hills from healthy plants.

MARTIN (W. H.). **Studies of Sweet Potato stem rot control.**—*Forty-eighth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1927*, pp. 225–232, 1928.

Tests to determine the reaction of sweet potato varieties to stem rot (*Fusarium hyperoxysporum* and *F. batatatis*) were continued during 1926 [*R.A.M.*, vii, p. 343], and observations were also made on the efficacy of setting more than one plant per hill in the reduction of infection. The results of the investigations [which are tabulated and discussed] showed that the White Yam, Red Brazil, and Yellow Yam varieties are very resistant to stem rot. Certain strains of Yellow Jersey are much more resistant than others, but there is no apparent correlation between susceptibility to stem rot and yielding power in the different strains. In most cases the use of two or three plants per hill, instead of one, led to an increased yield in both resistant and susceptible varieties.

Reports on diseases of plants in Ceylon during 1927.—*Ceylon Dept. of Agric. Tech. Repts. for the year 1927*, pp. (1)–(11), 1928.

In a special report on rice diseases W. C. Lester-Smith states that a careful inspection of the Kalutara and Matara districts revealed the presence of serious disease only in three localities. *Sclerotium oryzae* and *Rhizoctonia* [*Corticium*] *solani* were isolated from affected plants from two out of these three localities, while in the third only *S. oryzae* was present. The highest infection obtained in inoculation experiments conducted by the Mycologist [W. Small] was 29 per cent. with *S. oryzae* (in water) and 15·2 per cent. with *C. solani* (in soil), indicating that neither fungus is strongly parasitic under all conditions: of the two, *S. oryzae* appears to be the more destructive on the whole [*R.A.M.*, vi, p. 274; vii, p. 224]. The symptoms caused by the latter fungus include crumpling of the leaves and late tillering. The sclerotia are believed to be distributed by irrigation. Attention is drawn to the importance of burning all stubble, weeds, &c., in and near the rice fields.

Report on the effect on the development of mould of hanging Rubber in the factory after smoking.—*Trop. Agriculturist*, lxxi, 1, pp. 40–41, 1928.

The results of experiments in Ceylon and London, reported briefly in this note, indicated that sheet rubber which had been hung in the packing room for periods of about a fortnight after smoking developed moulds during transit more readily than samples packed immediately after smoking [*R.A.M.*, vi, p. 314].

Rayllo (A. I.). Материалы по изучению почвенных грибов. (Первое сообщение). [Materials for the study of soil fungi. (First communication).]—*Mitt. Abt. für Ackerbau Staatl. Inst. für Exper. Agron.*, Leningrad, 6, 27 pp., 8 figs., 1928. [German summary.]

After a brief review of the existing literature on soil fungi in Russia and abroad [the more recent of which has been noticed in this *Review*], the author gives some details of his investigation of the soil mycoflora in three widely separated points of European Russia, differing greatly ecologically, namely, in the neighbourhood of Murmansk in the extreme north-west; near Leningrad; and in the Kamennaya [Stony] Steppe, government of Voronezh, in the south. A list is given of the fungi isolated in each of these points, numbering 90 species in all, and in a separate list are enumerated the 48 species of soil fungi recorded in Russia that are also known to occur in other countries, with an indication of their geographical distribution. The latter list shows that the greatest number of widely distributed forms are Mucoraceae and species of *Penicillium*.

The paper terminates with descriptions (with Latin diagnoses) of one new genus (*Pseudogymnoascus*) of the Gymnoascaceae and of 12 new species isolated from soil by the author.

Salmon (E. S.) & Ware (W. M.). **The mosaic disease of the Hop; grafting experiments, I.**—*Ann. of Appl. Biol.*, xv, 3, pp. 342–351, 1928.

In this paper details are given of the condition in 1927 of the hop plants that had been grafted in 1926 by Thrupp [*R.A.M.*, vi, p. 690] with scions either from plants affected with mosaic disease, or from the seedling variety M 45 which had been previously proved to be a carrier of the disease. The fact that 13 of the 34 plants showed very pronounced symptoms of mosaic appears to indicate that the virus of the disease can travel down a grafted stem and infect the rootstock, and that the mere contact of a virus-carrying scion with the stock (even when the former dies off before growing) is sufficient to cause infection of the rootstock. This suggests that infection may possibly be caused by cutting the rootstock with a knife contaminated with the sap of a mosaic-diseased plant or of a carrier.

The entire resistance to mosaic of the commercial variety Fuggles was proved in experiments in which scions of this variety were grafted on a hop plant severely diseased with mosaic, but remained healthy throughout the experiment and completed their full seasonal development.

Salmon (E. S.). **Eleventh report on the trial of new varieties of Hops, 1927.**—*East Malling Res. Stat., Kent*, 18 pp., 1928.

A very severe attack of mosaic disease occurred in 1927 in the hop gardens at East Malling Research Station [*R.A.M.*, vi, p. 751]. As in previous seasons, the great majority of the 'new' varieties proved completely resistant although, in many cases, growing in close proximity to affected 'commercial' varieties.

For the fourth year in succession the cones of M 45 remained unattacked by downy mildew [*Pseudoperonospora humuli*: see next abstract], although the bines commonly showed 'spiked' shoots. Of the 'commercial' varieties, Fuggles remained similarly unaffected as regards attacks on the cones. It appears safe to regard M 45 and Fuggles as possessing cones truly resistant to *P. humuli*. Among other 'new' varieties the cones of which appear to be resistant to downy mildew are L 21, G 10, OC 60, OE 46, B 7, and P 43.

SALMON (E. S.) & WARE (W. M.). **Inoculation experiments with the downy mildews of the Hop and Nettle (Pseudoperonospora humuli (Miy. et Taka.) Wils. and P. urticae (Lib.) Salmon et Ware).**—*Ann. of Appl. Biol.*, xv, 3, pp. 352–370, 1928.

The authors state that in the light of their own studies and of the information [most of which has been noticed in this *Review*] published since 1925 by foreign investigators of the downy mildew of hops (*Pseudoperonospora humuli*), this fungus appears to be a species distinct from *P. urticae*, and to have been introduced into Europe about 1920 from Japan, or possibly North America. There is also evidence to show that, apart from the isolated outbreak of the disease in the Experimental Hop Garden at Wye College in 1920, the first infections in 1924 of hop gardens in the south-east of England most probably occurred by wind-borne spores coming from the Continent, where several countries were infected by 1923.

Inoculation experiments [full details of which are given] made in 1926 and 1927 showed that, under certain conditions, *P. humuli* is capable of infecting *Urtica urens*, and of producing spores on it, which are fully pathogenic to hops. No evidence was obtained, however, as to whether the fungus can establish itself permanently on the stinging nettle. On *U. dioica* and *Parietaria ramiflora* inoculations only produced a moderate or slight mycelial infection without the production of conidiophores. On both these hosts, therefore, only phenomena approaching sub-infection [*R.A.M.*, iii, p. 159] were obtained, while the inoculation of *Humulus japonicus* with spores from cultivated hops usually failed, but sometimes gave sub-infection.

Since *P. humuli* in its native countries has been observed only on species of *Humulus*, the fact that in Europe a species of *Urtica* can be artificially infected and bear spores may indicate a widening of its host range.

RAMOS (R. M.). **Experiences with Sugar Cane varieties in Oriente Province, Cuba, 1923–1927.**—*Planter and Sugar Manufacturer*, lxxxi, 6, pp. 101–104, 5 figs., 1928.

In this paper a descriptive table is given showing the best new varieties of sugar-cane tried in the province of Oriente, Cuba, from 1924 to 1927, together with brief notes on their respective agronomic properties, susceptibility to mosaic, and resistance to root disease, damp, and drought. Of the varieties so listed Cristalina, B.H. 10–12, Badila, S.C. 12/4, B. 1809, and D. 117 are fairly susceptible to mosaic ; P.O.J. 2725, 2714, and 2727 are almost immune ;

P.R. 543 is fairly susceptible, but less so than Cristalina; Co. 281 and 213 are fairly susceptible, but tolerant; and C.H. 64/21 is immune. Five of these varieties are recommended for propagation to replace the standard Cuban Cristalina cane, namely, the thick 'noble' canes B.H. 10–12, S.C. 12/4, and Badila, and the thick canes with 'wild blood' P.O.J. 2725 and 2714, which have one-eighth of Kassoer 'wild blood' parentage.

RANDS (R. D.), SHERWOOD (S. F.), & STEVENS (F. D.). **Sugar-cane variety tests in Louisiana during the crop year 1926–27.**—*U.S. Dept. of Agric. Circ.* 36, 14 pp., 1928.

In this report the results of the second season's comparative plot tests with mosaic-tolerant sugar-cane varieties in Louisiana are summarized and tabulated. The P.O.J. varieties 36, 213, and 234 again proved superior to the commonly grown canes [*R.A.M.*, vii, p. 741], 213 being specially promising, while 234 is inferior to the other two in ratooning capacity and is also more susceptible to root rot and other soil troubles [ibid., vi, p. 641]. Preliminary tests with more recently introduced, and as yet undistributed, varieties gave encouraging results in the case of P.O.J. 36–M and P.O.J. 2725. The former is stated to possess most of the advantages of P.O.J. 36, from which it is derived, and matures much earlier; it is, however, more susceptible to mosaic than the parent cane.

SUNDARARAMAN (S.). **Mosaic disease of Sugar-cane in South India.**—*Madras Agric. Dept. Bull.* 2 [of *1928*], pp. 5–13, 2 col. pl., 1 map, 1928.

In this paper (to which a popular introductory note is contributed by R. D. Anstead), the author reports the results of a survey of the Madras Presidency for sugar-cane mosaic from 1925 to 1928.

In the Godavari district the incidence of infection ranged from 3 to 30, with an average of 10 per cent.; in the Carnatic 2 per cent. was the average amount, though both there and at Pattambi on the west coast (where the disease in general was much less prevalent) up to 50 per cent. of mosaic was occasionally recorded. The affected varieties included Red, Purple, and Ashy Mauritius, B. 147, B. 208, B. 254, and B. 6388, Java Hebbal, Poovan, Vellai, Chittal, Fiji B, A. 2, Q. 116, Q. 813, J. 247, M. 55, D. 625, D. 1135, Local Reed, and Local Striped.

Two distinct types of mosaic were differentiated on the leaves of canes at Coimbatore. In the first and more common type, prevalent on Red Mauritius, Co. 1, M. 55, and Poovan, the normal green colour forms the background for irregular, whitish or pale whitish-yellow blotches. In the second, generally occurring on Java Hebbal and Vellai, the normal dark green colour appears in a few irregular islands spread over a pale green background. Usually the colour of the blotches deepens with age, while sometimes they coalesce.

Characteristic markings are often observed on the internodes of diseased stems. In the dark-rinded varieties, whitish or yellowish linear blotches appear. In advanced cases, these areas develop narrow, linear cankers resulting from the death of the rind tissue

[*R.A.M.*, i, p. 184]. Shrinking of the diameter of the cane and stunting are also noticed.

The chloroplasts are smaller, less regular in shape, and fewer in the diseased than in the healthy tissue. The pale areas in the leaves are thinner than the healthy green ones, and the cells in such areas are slightly smaller than those of the sound parts of the leaf. No intracellular bodies were observed by the author.

The results of experiments [details of which are given] to determine the mode of infection and spread of mosaic in South India indicate that the disease is transmitted by insects as well as through infected setts. In 1927 the disease spread from affected fields to healthy canes in the experimental plots, presumably through the agency of some of the insects observed on sugar-cane at Coimbatore [a list of which is given]. The results of preliminary tests showed that *Aphis maidis* flourishes on cane, but no definite evidence of its agency in the transmission of mosaic was obtained.

The results of varietal reaction trials [which are tabulated] emphasized the very high susceptibility of the Mauritius, Barbados, Java Hebbal, and local strains, and the great resistance of the P.O.J. (especially 2714) and Fiji varieties.

Secondary infections are perceptible when the crop is three months old, and the disease spreads rapidly during the next three months, after which there is a marked decrease.

Regular monthly inspections between the second and sixth months of growth should be made, and all mosaic plants eradicated. Where the incidence of infection is so high that roguing becomes impracticable, the crop should be allowed to mature and then be milled, care being taken to use none of the setts for seed. Roguing has given excellent results in Coimbatore in the reduction of secondary infection, but the importance of planting healthy setts to prevent the more formidable primary infection is strongly urged.

McRae (W.) & Subramaniam (L. S.). **A further note on the mosaic disease of Sugar-cane.**—*Agric. Journ. of India*, xxiii, 4, pp. 239–255, 3 col. pl., 1 map, 1928.

A brief description is given of the symptoms of mosaic disease of sugar-cane in India, especially of the stem markings observed at Coimbatore [see preceding abstract]. This symptom has not been observed on thin canes in northern India.

A list is given showing the incidence of mosaic in the different provinces of India (including Burma) [*R.A.M.*, vii, p. 559] and the varieties affected.

The results of varietal tests at Pusa [which are summarized and tabulated] show that, apart from Co. 232 (rejected on account of extreme susceptibility), the amount of mosaic on Coimbatore canes is small in North Bihar and relatively insignificant throughout northern India. However, in the tropical parts of India, e.g., Lower Burma, Co. 213 and Co. 210 are fully infected. The thick varieties in the tropical and northern regions are much more heavily attacked by mosaic (up to 100 per cent.).

Observations on the natural spread of mosaic in the field showed that in Pusa the extent of this process during 1927 was probably less than 1 per cent. on the thin Co. varieties, whereas on the thick

canes tested in Madras the corresponding figures were 50 to 80 per cent. for a group including Fiji B (Badila), Java Hebbal, Vellai, and Purple Mauritius, and 80 to 100 per cent. for Red Mauritius, D. 1135, and several others. It is considered probable that the disease was introduced into the Pusa nursery on Co. 223 from Lyallpur [Punjab], where this variety was subsequently found to show 36 per cent. infection.

During August, 1927, nine maize plants within 30 yards of two experimental sugar-cane plots developed mosaic mottling on the leaves. Three hundred acres of maize in the farm were examined, but no other case was found, and it seems clear that the individuals in question were infected from the diseased cane in the adjacent experimental plot.

Some data are presented showing the efficacy of roguing in the control of mosaic, while successful results have also been obtained at the Shahjahanpur Sugar-cane Research Station (United Provinces) by selection. In the first year the amount of infection on the susceptible varieties, e. g., Poundah, was reduced from as much as 100 to 5, and in the second year to 0·1 per cent.

SHEPHERD (E. F. S.). **Le 'leaf-scald'.** [Leaf scald.]—*Rev. Agric. de l'Île Maurice, 1928*, 40, pp. 176–178, 1928.

The occurrence of leaf scald of sugar-cane [*Bacterium* sp.] in Mauritius has now been definitely established. The symptoms of the disease are described in popular terms and differentiated from those of gummosis [*R.A.M.*, vi, p. 121], with which leaf scald is readily confused.

The Destructive Insect and Pest Act (Canada) and regulations thereunder.—*Acts, Orders and Regulations* No. 8 (2nd Revised edition, July, 1928), 29 pp., 1928.

The only amendment in this second revision of the Destructive Insect and Pest Act (Canada) [*R.A.M.*, iv, p. 767] relating to fungous diseases is the following. Regulation No. 6, designed to prevent the introduction into British Columbia of peach yellows [ibid., vii, p. 792] prohibits the importation into that province of all fresh peaches, peach nursery stock, and peach fruit pips or seeds for propagation from the States of Wisconsin, Illinois, Missouri, Arkansas, and Texas, and the area east thereof.

Legislative and administrative measures. Argentina.—*Internat. Rev. of Agric.*, N.S., xix, 8, pp. 748–749, 1928.

In accordance with a Presidential Decree dated 19th December, 1927, all insecticides, fungicides, and other plant protectives to be approved by the Ministry of Agriculture of the Argentine Republic must be packed in receptacles bearing conspicuous indications in Spanish concerning their composition, date of manufacture, mode and rate of application, and the like. These statements will be verified by technical experts of the Ministry before the preparations are sanctioned. The transit of plants to the interior of the country will be authorized only after treatment with an officially approved product.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

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McClean (A. P. D.). **Mosaic disease of Sugar Cane. With special reference to its eradication in Natal.**—*South African Sugar Journ.*, xii, 8, pp. 483–489, 1928.

Both European and Indian planters in Natal have complied with the regulations for the destruction of mosaic diseased sugar-cane and for the replacement of susceptible varieties by Uba [*R.A.M.*, vii, p. 64]. Some difficulty has been experienced in the elimination of the Agaul variety, which closely resembles Uba except in its susceptibility to mosaic. An inspection of the native farms is in progress.

In a report dated 9th February, 1928, H. H. Storey is stated to have recorded the recent discovery of mosaic on an indigenous perennial grass, *Setaria sulcata*, and the successful transmission of infection from this host to sugar-cane. Steps are being taken to eradicate the grass from the vicinity of the cane fields.

Shepherd (E. F. S.). **La gommose de la Canne-à-sucre.** [Gummosis of Sugar-cane.]—*Rev. Agric. de l'Île Maurice, 1928*, 40, pp. 173–176, 1928.

This is a popular account of gummosis of sugar-cane (*Bacterium vascularum*) [*R.A.M.*, vii, p. 473], from which none of the varieties cultivated in Mauritius is immune. A fair degree of resistance, however, is shown by R.P. 8, R.P. 6, P.O.J. 213, and B.H. 10 (12), while the new local varieties, M. 2316 and M. 2716 also appear promising in this respect.

Van Luijk (A.). **Ueber das Vorkommen von Torula sacchari Corda auf verschiedenen Substraten.** [On the occurrence of *Torula sacchari* Corda on various substrata.]—*Mitt. 'Centraalbureau voor Schimmelcultures', Verh. Akad. Wet. Amst.*, II Sect., xxvi, 2, pp. 22–23, 1928.

A sample of palm sugar obtained from *Arenga saccharifera* in the Dutch East Indies was examined at the 'Centraalbureau voor Schimmelcultures', Baarn (Holland), and found to be contaminated and decomposed by a fungus which was identified as *Torula sacchari*

Corda. The following are listed as synonyms of this organism: *Penicillium simplex* Lindner, *Catenularia fuliginea* Saito, *T. pulchra* Tengwall [*R.A.M.*, iv, p. 60], and *T. fuliginea* (Saito) Berkhout [ibid., iii, p. 556]. A very similar species of *Torula* was isolated at the Centraalbureau from watermelon from South Africa. *T. sacchari* appears to be widely distributed over the whole world, developing in sugar or highly concentrated sugar solutions.

DEARNESS (J.). **New and noteworthy fungi. V.**—*Mycologia*, xx, 4, pp. 235–246, 1928.

Continuing his compilation of new and interesting fungi collected in Canada and the United States [*R.A.M.*, vi, p. 126], the writer here enumerates 15 Sphaeropsidales, 6 Leptostromatales, and 16 Melanconiales, of which the following (all new species except the three last-named) may be mentioned. *Stagonospora phaseoli* produces arid or whitish, red-bordered spots on the upper side of bean (*Phaseolus vulgaris*) leaves, usually in association with *Cercospora canescens*. *Colletotrichum viciae* (allied to *C. carpophilum*) causes a yellow or white discoloration of the leaves of *Vicia villosa*. *Hendersonula pinicola* was found on partly green needles of *Pinus strobus* affected by a needle blight cast, but owing to the admixture of other species its parasitism was not clearly established. *Septoria pinicola* was found on blighted needles of the lower limbs of *P. virginiana*. *S. boycei* produces pale reddish-brown circular spots, up to 7·5 mm. in diameter, on the leaves of *Betula fontinalis*. *S. sitchensis* produces small, widely scattered lesions, red above and yellow below, on living leaves of *Pyrus sitchensis*. *Leptothyrium pseudotsugae* was found causing the development of 'fly specks' on living leaves of *Pseudotsuga taxifolia*, *L. stenosporum* on blighted needles of *Pinus strobus*, and *L. hedgcockii* on living needles of *P. rigida*. (?) *Leptothyrella laricis* was found in a parasitic form on the needles of *Larix occidentalis*, sometimes associated with *Hypodermella laricis* var. *octospora*, of which it is believed to be the conidial stage. *Rhabdogloeum abietinum* occurred as a parasite on the needles of *Abies fraseri*. *Septogloeum rhopaloideum* produces numerous small, confluent, water-grey to cinereous spots on the leaves of *Populus tremuloides*. *Monochaetia pinicola* was found on blighted needles of *Pinus palustris*. *Cryptosporium boycei* causes the development of cankers on withering branches and small trunks of *Pseudotsuga taxifolia*. *C. acicolum* Thuem., closely associated with the red spot of *Pinus palustris* needles, while not regarded as a typical *Cryptosporium*, is considered to be better placed in the latter genus than in *Septoria* as is sometimes done [ibid., iv, p. 527]. *Coryneum microstictum* Berk. & Br. var. *foliae* n. var. causes a destructive brown spotting of cultivated rose leaves. *C. septosporioides* was found producing serious cankers on the branches of *Acer negundo*.

SEAVER (F. J.). **Studies in tropical Ascomycetes. V. Species of Phyllachora.**—*Mycologia*, xx, 4, pp. 214–225, 6 pl., 1928.

In the course of mycological work in the tropical islands of the New World, the writer has been impressed by the number of

species of *Phyllachora* (*sensu latu*) occurring in those regions on dicotyledonous hosts. In this paper an attempt is made to enumerate, with brief diagnoses, a part of the species from tropical America, the remainder being reserved for future publication. Of the 28 species recorded from the West Indies, Porto Rico, South America, and elsewhere, four are new and two are new combinations.

BUCHHEIM (A.). **Biologisch-morphologische Untersuchungen an Erysiphaceen.** [Biological and morphological investigations on Erysiphaceae.]—*Ber. Deutsch. Bot. Gesellsch.*, xlvi, 3, pp. 167–180, 3 figs., 1 graph, 1928.

Inoculation experiments with *Sphaerotheca humuli* on *Alchemilla vulgaris* supported Blumer's conclusions as to the adverse effect of high atmospheric humidity (95 to 98 per cent.) on perithecial formation [*R.A.M.*, vi, p. 643]. Even conidial production was delayed under these conditions, and the mildew lesions lost their sharply defined appearance.

Cross-inoculation experiments proved the identity of *Erysiphe polygoni* on *Caragana arborescens* with the form occurring on *Robinia pseud-acacia*. The perithecia of the fungus from *C. arborescens* (Moscow) measured 97 to 118 μ compared with 97 to 105 μ for Blumer's form [ibid., vi, p. 59] and 71 to 107 and 80 to 108 μ for two strains of the fungus from *R. pseud-acacia*. These differences are not considered sufficient, however, to justify regarding the various forms as separate species. In this connexion it is mentioned that the characters of *Trichocladia robiniae* Czerniecka (Jaczewski's Powdery mildew fungi, Leningrad, 1927) [ibid., vii, p. 346] are not sufficiently distinctive to warrant its separation from *E. polygoni*.

The perithecial dimensions of *Microsphaera quercina*, collected in 15 different places in Russia, range between 93 to 105 and 116 to 136 μ, and it is suggested that the species should be subdivided. The perithecia appear to be showing a tendency to decrease in size and to occur almost exclusively on the under side of the leaves.

BENNETT (F. T.). **On Dematium pullulans de B. and its ascigerous stage.**—*Ann. of Appl. Biol.*, xv, 3, pp. 371–391, 2 pl., 5 figs., 1928.

A detailed account is given of the author's investigation of *Dematium pullulans* [*R.A.M.*, iii, p. 371], a brief historical survey of which is included. Many of his isolations (made from over a dozen different host plants) gave an exactly similar form of the organism, but some, even from a single source, showed slight morphological and more definite cultural differences. The six forms selected for detailed comparison were obtained as follows: two from wheat leaves, in association with *Cladosporium herbarum*; two from dead cherry flowers; one from an Ascomycete which was found to occur naturally on wheat, and which was later proved to be the ascigerous stage of *D. pullulans*; and a strain from wheat obtained after inoculation with the preceding form. Pure cultures of these forms were raised from single bud-spores ('sprout cells'),

with the exception of the culture of the ascigerous form from wheat, which was raised from a single ascospore, and produced a conidial stage indistinguishable microscopically from the others. A detailed description of the cultural characters of these forms on a malt gelatine medium is given, while the characters on other media are more briefly compared. Though the cultural characters of all the strains exhibited a gradual transition, so that the macroscopical aspect of the extreme members of the series was very different, no clear microscopical differences were observed.

The ascigerous stage was found occurring in the autumn on wheat straw. It appeared as a blackish clypeus projecting slightly above the surface of the straw; the largest fructification observed was about 1 mm. in diameter and had some twenty ostioles. The perithecia are globoid and bounded by a many-layered, pseudoparenchymatous tissue. The mature perithecium has a dark brown wall several cells thick, and measures 160 to 175 by 200 μ or more, while the ascogenous cavity is 160 μ broad at the base and 130 μ high. The fasciculate asci arise from very slender, interwoven hyphae which form the base of the cavity. The mature ascus, measuring 85 to 90 by 4 μ, is an exceedingly delicate, hyaline membrane, evanescent after the discharge of the spores, without pore, lid, or apical thickening. There are no paraphyses. The ascospores are one-seriate, hyaline, elliptical, unicellular, and measure 8 to 10 by 3 μ. In the process of germination nearly all the ascospores develop a median transverse septum. They are capable of germinating in the same autumn as produced, at any temperature between 6° and 23° C. In water the ascospore emits a narrow, hyaline germ-tube from one or both ends, which soon produces lateral branches, after which septa are formed. In a nutrient solution containing salts and dextrose, the germ-tube may bear bud-spores instead of branching, septa being developed immediately below the bud protuberances. The ascospores retained their vitality unimpaired after the perithecia had been exposed to low temperatures throughout a very severe winter, but were killed by exposure for three minutes to moist heat at 50° C.

Immature perithecia were formed on artifical media by the two forms from cherry flowers and by the strain obtained from wheat after inoculation with the ascigerous form occurring in nature, but their production was erratic and efforts to stimulate it failed. They appeared at places where the olive-black edges of two colonies met (thus suggesting a dioecious nature of the mycelium), in the shape of smooth, glossy black, closed bodies, the size of pinheads, containing immature asci identical with those contained in immature perithecia in nature. When cultured these bodies invariably gave rise to a typical growth of *D. pullulans*, without trace of any other fungus. The ascigerous stage in culture was associated with an olive or black growth of the mycelium, and cultures from this stage in nature gave the greatest amount of this type of growth throughout. The ascigerous stage is referred to the genus *Anthostomella* and named *A. pullulans*.

Inoculation experiments on wheat seedlings showed that the fungus is saprophytic or weakly parasitic, being unable to attack healthy tissues.

SEAVER (F. J.). **Notes and brief articles.**—*Mycologia*, xx, 4, p. 248, 1928.

The author's attention has been called by E. W. Mason to the fact that Saccardo established the genus *Calospora* for Möller's *Sphaerostilbe longiascus*, to cover forms with a Stilbaceous conidial stage. *Macbridella striispora* [*R.A.M.*, vii, p. 602] therefore becomes *C. striispora* (Ell. & Ev.) comb. nov.

GADD (C. H.). **The parasitism of Rosellinia arcuata.**—*Tea Quarterly*, i, 3, pp. 55–60, 2 pl., 1928.

This is an amplified account of the writer's experiments, a preliminary note on which has already been published [*R.A.M.*, vii, p. 746], with *Rosellinia arcuata* on tea in Ceylon. Pure cultures of the fungus isolated from a diseased mature bush were used to inoculate tea seedlings established in pots. After two months the inoculated seedlings drooped and died, and the fungus was found to have attacked the tap-root near the collar and to have extended down along it and into some of the lateral roots. The finer feeding roots, however, were mostly uninjured. The control plants remained healthy. No trace of *Rhizoctonia bataticola* was found on the roots of any of the plants, nor could any evidence of the presence of a parasite other than *R. arcuata* be obtained by testing the effect on tea roots of various other fungi that occurred on them, after isolating and growing these fungi in pure culture.

GADD (C. H.). **Treatment of Tea root diseases.—Diagnosis and control.**—*Planters' Chron.*, xxiii, 32, pp. 613-618; 33, pp. 634–635, 1928.

In this paper (reprinted from the *Times of Ceylon*—Mail Edition, 16th July, 1928), the writer gives instructions in popular terms for the diagnosis and control of some important root diseases of tea.

In connexion with the *Diplodia* disease [*Botryodiplodia theobromae*: *R.A.M.*, vii, p. 745], attention is called to the following significant features. (1) The disease occurs only after pruning; (2) it occurs most often at mid and low elevations where growth is forced by climatic conditions, i. e., where the plucking rounds are most frequent and the pruning cycle is shortest; (3) it does not spread in the same way as most root diseases due to parasitic organisms. These facts suggest that the disease is primarily of physiological origin, and that the organisms usually found on infected roots are only of secondary importance. Recent investigations from this new standpoint have shown that diseased roots are deficient in food reserves (starch), the store of which is depleted in the effort to form new growth after pruning. The lighter form of pruning now coming into general use in low-country districts may possibly assist in the prevention of the disease. Resting the bushes before pruning may also be an effective remedy in affected estates.

Directions are further given for the control of the brown root disease [*Fomes lamaoensis*], *Ustulina* [*zonata*], *Poria* [*hypolateritia* and *P. hypobrunnea*], and *Rosellinia* [*arcuata*: see preceding abstract] by the destruction of diseased roots and the digging of

trenches to prevent further spread. The use of lime in the treatment of root diseases cannot be recommended on the basis of the author's observations.

Briefly referring to the current view as to the parasitic nature of *Rhizoctonia bataticola* [*Macrophomina phaseoli*: ibid., vii, p. 701], the writer states that unpublished recommendations for the control of this form of root rot include the application to the soil of 1 to 2 lb. of lime and 1 to 2 oz. of wood ashes or other potash manure. This is obviously intended to correct a supposed deficiency of potash in the soil, of which, however, most Ceylon tea soils contain an adequate supply. On the whole, the success of the practices of trenching and stump removal has amply justified their adoption, which is stated to have led to a considerable reduction in the incidence of root diseases in the last 15 or 20 years. For the present, the improvement of the existing system of control seems more promising than its replacement by what the author regards as purely experimental practices.

STEINMANN (A.). **Over de Diplodia-wortelziekte van de Thee.** [On the *Diplodia* root disease of Tea.]—*Arch. voor Theecult. Nederl.-Indië*, ii, 1–2, pp. 59–73, 5 pl., 1928. [English summary.]

Diplodia root disease of tea (*Botryodiplodia theobromae*) [see preceding abstract] was reported for the first time from West Java in 1926.

B. theobromae is not primarily a root fungus but occurs on the branches and fruits of cacao and a number of other tropical hosts. Its presence on the roots of *Hevea* rubber and tea [*R.A.M.*, vi, pp. 183, 644] is therefore regarded as a departure from the normal habit.

As a rule no trace of the fungus is discernible on the exterior of the root. However, the wood and phloem rapidly assume a uniform greyish-black discoloration. The black, bicellular pycnospores, produced by the pycnidia after they rupture the cortex, measure 25 to 30 by 12 to 15 μ, and often occur in such numbers that the affected branch or root presents a sooty appearance. A remarkable feature of *Diplodia* infection on tea roots is the development, round the black lesions formed by the erumpent pycnidia, of a white, chalky margin consisting of the mycelium and spores of a species of *Actinomyces*, the exact rôle of which in the etiology of the root disease has not yet been fully investigated.

B. theobromae primarily attacks tea bushes which have been weakened through various causes. It enters through wounds inflicted by mechanical agencies, frequently in company with another well-known wound parasite of tea, *Ustulina maxima* [*U. zonata*]. The practice of burying prunings in the tea plantations is a very prolific source of infection by *B. theobromae*. In one case the fungus was introduced into the soil with the prunings of *Tephrosia candida* and readily infected the tap roots of the tea bushes through wounds made during transplantation. On the same estate 80 per cent. of the nursery plants were killed by the disease. Cases have also been observed in which *B. theobromae*, in association with *Rhizoctonia bataticola* [*Macrophomina phaseoli*:

see next abstract], penetrated the tissues of stems previously injured by sun scorch just above soil level [cf. ibid., v, p. 761]. In one such instance 90 per cent. of the seedlings in a plantation about 17 hect. in extent were killed. During 1927, some 380,000 tea bushes were eradicated in one district in consequence of combined drought and *Botryodiplodia* injury, while on another estate in the same locality 492,000 bushes were lost in 1927 through the attacks of *Ustulina* and *Botryodiplodia*.

B. theobromae is also found causing a die-back of *Albizzia*, *Deguelia microphylla*, and dadap [*Erythrina*]. The fungus is disseminated exclusively by means of the pycnospores and not, like the true root fungi, by the mycelium in the soil or by contact between diseased and healthy roots. In contrast to Ceylon experience, there is little evidence in Java to suggest the penetration of *B. theobromae* through pruning wounds.

STEINMANN (A.). **Voorloopige mededeeling omtrent het optreden van Rhizoctonia bataticola (Taub.) Butler op Java en Sumatra.** [Preliminary note on the occurrence of *Rhizoctonia bataticola* (Taub.) Butler in Java and Sumatra.]—*Arch. voor Theecult. Nederl.-Indië*, ii, 1–2, pp. 74–86, 6 pl., 1928. [English summary.]

Towards the end of 1927 the presence of *Rhizoctonia bataticola* [*Macrophomina phaseoli*] was detected for the first time in Java on tea, coffee, *Albizzia*, and rubber roots. In May, 1928, the fungus was also observed on tea and *A. falcata* in Sumatra. On tea *M. phaseoli* generally occurred alone, causing in most cases the death of small groups of bushes, but in two of the cases under observation it was accompanied by *Diplodia* [*Botryodiplodia theobromae*: see preceding abstracts]. One rubber tree was simultaneously infected by *Rigidoporus microporus* [*Fomes* sp.: see next abstract]. The author's material of *M. phaseoli* was submitted for inspection to Dr. Small, who confirmed the identity of the fungus.

M. phaseoli is generally found in the tissues of the more delicate roots both in the wood and bark, and only in exceptional cases is present in the larger roots. The almost complete absence of external symptoms of infection on the diseased roots probably accounts for previous failures to ascertain the true cause of death in many obscure cases formerly attributed to physiological factors. Internally the affected roots show a brownish or, less often, a greyish discoloration very similar to that caused by *B. theobromae*, and the diseased wood is invariably hard, dry, and brittle.

On cornmeal agar the fungus forms hyaline, later brown hyphae in which, the author states, occasional clamp-connexions occur. The cells are generally swollen and show distinct constrictions at the septa. Both in culture and in nature the presence of round, swollen, dark brown cells, believed to be chlamydospores, has been observed. The distinguishing feature of *M. phaseoli*, however, is the presence of small black sclerotia in the cortical tissues or in the wood, and the occurrence of sclerotial plates of varying size and shape. At the edge of the nutrient medium the incipient sclerotia appear as small black points, while in the tissues they assume the form of the cells. The cell walls of the sclerotial pseudoparenchyma

are dark brown and comparatively thick, and usually the formation of the sclerotia coincides with the gradual disappearance of the hyphae from the tissues.

M. phaseoli has been found at various elevations and under widely divergent climatic and soil conditions in Java and Sumatra. No definite correlation has yet been found between the hydrogen-ion concentration and other characteristics of the soil and the occurrence of the fungus.

The fact that *M. phaseoli* has been found killing tea bushes in Java and Sumatra without the assistance of any other organism is considered amply to demonstrate its parasitic character under the prevailing conditions. On the other hand, Park's recent discovery of this fungus in a mycorrhizal form on healthy tea roots in Ceylon [ibid., vii, p. 604] suggests that it is a common endophyte which requires the influence of certain conditions, as yet unknown, to stimulate it to parasitic activity. Endotrophic mycorrhiza (probably formed by *M. phaseoli*) have also been found by the writer on healthy tea and *Cinchona* roots in Java.

PETCH (T.). **Fomes lignosus.**—*Tea Quarterly*, i, 3, pp. 64–66, 1928.

Discussing Briton-Jones's contention that *Fomes lignosus* plays little or no part in the etiology of root rot of citrus and cacao in Dominica [*R.A.M.*, vii, p. 715], the author points out that his experience in Ceylon has been very different. A case is recorded, in the latter country, in which the fungus killed a rubber tree at the head of a small valley and thence spread downwards, destroying all the cacao and coco-nuts in its path. The explanation of this apparent discrepancy in the behaviour of *F. lignosus* in different countries is stated to be the fact that two different species have been confused under the same name. The fungus known as *F. lignosus* in the West Indies is identical with *Polyporus microporus* (Sw.) Fr. [cf. ibid., iv, p. 636], the latter name having priority over the former, which should be discarded as a synonym. The correct name of the fungus called *F. lignosus* in the East is not known, but it is not identical with the West Indian species. A fuller account of the taxonomy of these organisms is in preparation.

DUNLAP (A. A.). **Effects of mosaic upon the chlorophyll content of Tobacco.**—*Phytopath.*, xviii, 8, pp. 697–700, 1 graph, 1928.

It was found that the content of saponified green pigments (chlorophyll *a* and *b*) is considerably lower in entirely mosaic-diseased than in healthy tobacco plants at all stages of growth, the former containing only 62 per cent. as much total chlorophyll as the latter. The amount of green pigment in any mosaic leaf of a tobacco plant was shown to be sub-normal when compared with leaves of similar age on healthy plants. The deficiency of chlorophyll is somewhat more marked in young than in old tissues and decidedly so in those that develop after infection, but even the older leaves formed before infection were eventually found to contain somewhat less chlorophyll than normal, though they showed no signs of mottling. Aqueous solutions of the saponified chloro-

phylls from mosaic material have been observed to be almost invariably of a yellowish-green colour as compared with the bluish-green of normal extracts, possibly owing to a preponderance of chlorophyll *b* in the former [cf. *R.A.M.*, iv, p. 755].

MOUTIA (A.). **Sur un des modes de transmission de la mosaïque du Tabac.** [On one of the modes of transmission of Tobacco mosaic.]—*Rev. Agric. de l'Île Maurice, 1928,* 40, pp. 179–180, 1928.

In view of the progressive extension of tobacco mosaic in Mauritius [*R.A.M.*, vii, p. 476], an experiment was recently undertaken to ascertain the mode of transmission of this disease. Five out of 15 plants were set in soil previously moistened with water in which fresh mosaic tobacco leaves had been pounded. A fortnight later four of these five plants showed mosaic symptoms while the ten controls remained healthy. In a second test, 5 out of 15 plants were similarly treated, except that dry instead of fresh diseased leaves were added to the water: all these plants developed mosaic in a fortnight, the ten controls being unaffected. These results are thought to show clearly that tobacco mosaic is transmissible through the soil.

JOCHEMS (S. C. J.). **Een nieuwe virusziekte van Deli-Tabak, de Rotterdam B-ziekte.** [A new virus disease of Deli Tobacco, the Rotterdam B disease.]—*Bull. Deli Proefstat. te Medan-Sumatra,* 26, pp. 5–26, 3 pl., 1 fig., 1928. [English summary.]

Further particulars are given concerning the symptoms and etiology of the so-called 'Rotterdam B' disease of tobacco [*R.A.M.*, vi, p. 444], which has been prevalent since 1926 on the alluvial sandy loam or clay soils of the Deli coastal plain, especially on the widely cultivated commercial strains 8 and 180 Deli Mij, though probably other types are susceptible. In general, the economic loss has hitherto been relatively slight as the diseased plants are mostly scattered. Cases have occurred, however, in which 500 to 600 plants have been attacked on small plots, and in one part of the Medan estate some 30,000 plants were damaged in 1927.

The symptoms of the Rotterdam B disease closely resemble those of stipple-streak of potato as described by Atanasoff [ibid., ii, p. 285]. Besides the leaf mottling and distortion already described in the above-mentioned paper, the pith and vascular ring of the stem show large, brown necrotic areas. Similar lesions subsequently develop also in the cortex, over which the epidermal cells collapse, causing depressions in the stem. The whole stem turns black, the leaf veins wrinkle, and turgescence is lost some days before the death of the plant. A remarkable feature of the advanced stages of Rotterdam B disease is the so-called 'chambering' of the pith [division of the cavity by disks of tissue], similar to that occurring in cases of infection by *Phytophthora nicotianae* and *Pythium* spp. [ibid., vi, p. 445]. When almost full-grown plants are infected, the veins and midrib turn black, wrinkle, fade, and eventually the leaves drop. New leaves developing in these large

plants during the 8- to 10-day incubation period show small necrotic or chlorotic areas over their entire surface and do not attain a size of more than 10 cm., while the newly developed stem portion shows neither internal nor external necrosis, and the plant flowers and produces normal seed but only reaches half the usual height.

Inoculation experiments [which are fully described] with the expressed sap of diseased leaves and stems gave positive results in every method tested. Eighty per cent. of the attempts to induce infection by grafting diseased tops on to healthy stems were successful, while only 15 to 30 per cent. of the plants inoculated through wounds became affected. In the field, infection was readily disseminated by crushing the leaves of ten-day old plants between the fingers dipped in the expressed sap of diseased plants, or by rubbing them with fragments of attacked stems. Nearly all the plants thus treated contracted infection in a week. Only a small proportion of 30- to 40-day-old plants became infected when similar experiments were performed on full-grown leaves, whereas when young top leaves were inoculated the disease almost invariably developed. Insect transmission is not thought to play any considerable part in spreading infection under Deli conditions, nor was any evidence obtained that spread through the soil occurs. Inoculation tests with the filtrate from the expressed sap of diseased plants showed that the infectious principle for the most part remains behind on a Berkefeld filter, though a few successful infections resulted. Inoculations on a number of other Solanaceae with a view to finding additional hosts of the Rotterdam B disease were successful only on *Nicotiana silvestris*.

The symptoms of the disease under discussion do not agree with those of any of the mosaic conditions described by Johnson [ibid., v, p. 509], or with ring spot [ibid., vii, p. 478], and it is accordingly assumed that Rotterdam B is a new and distinct virus disease of tobacco.

JOCHEMS (S. C. J.). **Vier nieuwe waardplanten van Bacterium solanacearum E. F. S.** [Four new host plants of *Bacterium solanacearum* E. F. S.]—*Bull. Deli Proefstat. te Medan-Sumatra*, 27, pp. 29–32, 1928.

Since the compilation, in 1924, of a host list for *Bacterium solanacearum*, with special reference to the occurrence of slime disease in the Deli tobacco estates [*R.A.M.*, iv, p. 318], the writer has discovered infection by this organism on four new plants, viz., *Fleurya interrupta*, *Phytolacca octandra*, *Sesbania grandiflora*, and *Ruellia tuberosa*, from all of which the organism was isolated and determined by cultural characters and infective power on young tobacco and tomato plants. Only the two first are of importance in connexion with the spread of slime disease, both being common weeds on tobacco estates.

In 1926 the host range of *Bact. solanacearum* was increased by two, viz., banana and cassava [ibid., v, p. 678; vi, p. 142], bringing the total number known to 134 species, comprising 100 genera in 38 natural orders.

VAN BEYMA THOE KINGMA (F. H.). **Ueber einen Pilz aus fermentierenden Tabakhaufen auf Deli, Andreaea deliensis Palm et Jochems (= Oospora nicotianae Pezz. et Sacc.).** [On a fungus from fermenting Tobacco stacks in Deli, *Andreaea deliensis* Palm et Jochems (= *Oospora nicotianae* Pezz. et Sacc.).]—*Mitt. ' Centraalbureau voor Schimmelcultures ', Verh. Akad. Wet. Amst.*, II Sect., xxvi, 2, pp. 18–20, 1928.

An examination was made at the 'Centraalbureau voor Schimmelcultures', Baarn (Holland), of cultures of the fungus isolated in 1923 from fermenting tobacco stacks in Deli (Sumatra) and named *Andreaea* [*Andreaeana*] *deliensis* [*R.A.M.*, iii, pp. 436, 437].

It appears that, in the original diagnosis, confusion arose between two distinct organisms, viz., the fungus actually inhabiting the stacks, which agrees in all respects with *Oospora nicotianae* Pezz. et Sacc., and another occurring only on the exterior and accidentally introduced into the cultures. The latter organism [which is not named] produces a lemon-yellow mycelium (in contrast to the greyish-white one of *O. nicotianae*) and sclerotia of the same colour. The optimum temperature for sclerotial production was found to be 34° C. and the maximum below 39°, at which point *O. nicotianae* develops profusely.

A revised diagnosis of the tobacco stack fungus under the name of *O. nicotianae* is given.

SEVERIN (H. H. P.). **Tomato yellows or Tomato curly top.**—*Phytopath.*, xviii, 8, pp. 709–710, 1928.

Referring to Shapovalov's proposal to change the name of 'tomato western yellow blight' to 'yellows' [*R.A.M.*, vii, p. 478], the writer considers that 'curly top' should be substituted for 'yellows' in order to avoid confusion with other insect-borne plant diseases such as aster yellows, and also with those due to *Fusarium* (e. g., cabbage yellows).

JØRSTAD (I.). **Nord-Norges skogsykdommer.** [Forest diseases of northern Norway.]—*Tidsskr. for Skogbruk*, xxxvi, 8, pp. 365–456, 31 figs., 1928.

This account of the fungous diseases occurring in the forests of northern Norway is stated to be based partly on the author's visits to Nordland, Troms, and Finmark in 1922, 1924, and 1926, and partly on literature records from 1774. Many of the diseases of conifers have already been dealt with in a previous report [*R.A.M.*, v, p. 196], and besides further notes on the pathology of these trees, the present paper discusses fungal diseases of the birch, aspen, alder, willow, bird-cherry, and some less important trees in the region referred to.

KALSHOVEN (L. G. E.). **De beschadigingen, ziekten en plagen van de Djatibosschen op Java.** [The injuries, diseases, and pests of the Teak forests of Java.]—*Tectona*, xxi, 8, pp. 593–623, 1928. [English summary.]

Brief notes are given on the following diseases of teak [*Tectona grandis*]. Slime disease (*Bacterium solanacearum*) is well known on teak in Deli (Sumatra) [*R.A.M.*, vi, p. 759], but its occurrence

in young plantations in Java is less familiar. Such symptoms as sudden wilting and brown discoloration are probably largely attributable to this disease.

Root rot, due to a fungus of undetermined position, is prevalent on land formerly occupied by species of *Artocarpus* and *Ficus* [ibid., v, p. 396].

Mention is made of the investigations of Miss Schwarz and Altona on the 'djamoer oepas' disease (*Corticium salmonicolor*) [ibid., v, p. 457].

The cause of heart rot, associated with a brown discoloration of the medulla and wood, especially of young trees, [ibid., iii, p. 9], has not yet been ascertained. Possibly a species of *Diplodia*, observed by Miss Doyer in 1927 in sickly teak plantations, may play a part in the causation of heart rot.

Miss Schwarz has described a marasmioid fungus (cobweb disease) [thread blight] in the Java teak forests [ibid., vi, p. 384].

An apparently undescribed fungus produces concentric lesions on the leaves, especially on those of shoots arising from stumps, and the frequent occurrence of *Uredo tectonae* on old foliage has also been recorded.

DACHSELT (E.). **Die Blattfallkrankheit bei Platanen.** [The leaf fall disease of Plane trees.]—*Die Kranke Pflanze*, v, 8, pp. 124–125, 1 fig., 1928.

A brief, popular account is given of the leaf fall of plane [*Platanus*] trees caused by the conidial stage (*Gloeosporium nervisequum*) of *Gnomonia veneta* [*R.A.M.*, vi, pp. 63, 215; vii, p. 285], which is stated to have been conspicuous at Dresden during the summer of 1928.

GANTE (T.). **Spätfrostschaden an Platanen oder pilzlicher Befall?** [Late frost damage to Plane trees or fungous infection?]—*Blumen- und Pflanzenbau*, xliii, 9, pp. 133–134, 3 figs., 1928.

Plane [*Platanus*] trees in the Rhine Province are reported to have suffered severely during the early summer of 1928 from the attacks of *Gnomonia veneta* [the symptoms and life-history of which are described in popular terms: see preceding abstract]. The disease may be controlled by drastic pruning, supplemented wherever possible by preventive applications of Bordeaux mixture.

DUCOMET (V.). **À propos de l'anthracnose du Platane à Paris et dans la banlieue parisienne.** [Note relative to anthracnose of the Plane tree in Paris and its outskirts.]—*Bull. Soc. Nat. Hort. de France*, Sér. 5, i, pp. 379–382, 1928.

A severe epidemic of anthracnose (*Gnomonia veneta*) was reported on plane [*Platanus*] trees in Paris and its environs (especially the western suburbs) during 1928 [see preceding abstracts]. A partial parallel is drawn between this disease and leaf scorch of horse chestnuts (*Aesculus hippocastanum*), a physiological affection which is prevalent in districts where the planes are relatively free from anthracnose. Leaf scorch of horse chestnuts, however, is a concomitant of drought, while the anthracnose fungus is favoured

by damp conditions. It is concluded that further investigations are necessary to determine the exact connexion between meteorological and environmental conditions and the occurrence of these diseases.

OBERFELL (C. R.). **The future of Chestnut tanning materials.**—*Chem. & Metall. Engin.*, xxxv, 8, p. 468, 1928.

The chestnut tree in the United States is doomed to extinction as a result of blight [*Endothia parasitica*: *R.A.M.*, vii, p. 685], but the supply of extract for tanning purposes is not likely to be affected for the next twenty or thirty years owing to the abundant supply of dead trees. The extraction processes, however, require certain alterations before they can be applied to dead wood. The rate of decay in chestnut wood is slow, and it is believed that trees will continue to stand and be available for extract for fifteen or twenty years after they are killed by blight. The first serious effects of the gradual depletion of the stand are likely to be felt in the Lynchburg and Blue Ridge districts of Virginia.

HAFIZ KHAN (A.). **A preliminary report on the Peridermiums of India and the occurrence of Cronartium ribicola Fisch. on Ribes rubrum Linn.**—*Indian Forester*, liv, 8, pp. 431–443, 8 pl., 1928.

After a general discussion of the history and morphology of the genus *Peridermium*, the author enumerates and comments on nine species occurring in India, the host and localities of origin being indicated in each case. The species discussed are the following: *P. thomsoni* and *P. piceae* on *Picea morinda*, *P. cedri* on *Cedrus deodara*, *P. complanatum* and *P. himalayense* on *Pinus longifolia* needles and stems, respectively [*R.A.M.*, vii, p. 553], *P. brevius* and *P. indicum* on *Pinus excelsa* (needles and stems, respectively) [ibid., vii, p. 207], *P. ephedrae* on *Ephedra vulgaris*, and *P.* (near *cerebrum*) on *Pinus khasya* stems.

P. himalayense [apparently a new species to be described by Bagchee and covering the former *P. complanatum* f. *corticola*: ibid., ii, p. 42] is stated to be the most common and destructive of all the Indian pine rusts. Young saplings and poles are severely attacked and killed outright, while older trees seldom suffer. The fructifications are borne on fusiform swellings and are evident from the beginning of the hot weather till the end of the rains [about May to September]: they consist of innumerable conspicuous orange-red pustules projecting horizontally like small, blunt spikes emerging through the bark cracks. Deep fissures resembling cankers develop in the affected regions. The teleuto stage of the fungus, which is considered to be quite distinct from *P. complanatum* on the needles, has not yet been found. *P. himalayense* has been reported from Chakrata, Simla, and Kumaun (Himalaya).

P. indicum is sometimes found on the stems of young seedlings and saplings of *Pinus excelsa* in the Himalaya, e.g., in several localities in the Punjab and at Jaunsar (United Provinces). Although this fungus causes little damage at present, it is showing a marked tendency to increase and may soon become a serious menace if allowed to continue unchecked.

The species of *Peridermium* allied to *P. cerebrum* was received in 1918 from Assam, where it was associated with a woody excrescence almost as large as a football on the stems of *Pinus khasya*.

Cronartium ribicola has been collected on *Ribes rubrum* at Hazara (Punjab), but so far the inoculation experiments with this organism on *Pinus excelsa* have given negative results.

BOYCE (J. S.). **A conspectus of needle rusts on Balsam Firs in North America.**—*Phytopath.*, xviii, 8, pp. 705–708, 1928.

In this paper the writer presents a table, accompanied by explanatory notes, showing the genetic relationships between the different stages of the rusts (*Caeoma americana* and *Peridermium* spp.) occurring on balsam firs (*Abies* spp.) in North America, particularly in the Pacific Northwest.

DAY (W. R.). **Damage by late frost on Douglas Fir, Sitka Spruce, and other conifers.**—*Forestry*, ii, 1, pp. 19–30, 1 pl., 1928.

In this paper the author describes the effect of frost on the cambium of coniferous trees. If sufficiently intense this tissue may be killed, but less severe cold merely stimulates the formation of abnormal cells. A frost ring results within the wood, sometimes consisting in part of killed cells and in part of abnormally developed ones. In severe killing, open cankers may result: they have generally been observed only on trees up to 10 or 12 feet high. When they girdle the stem they may result in a die-back of the leading shoot, if situated near the top of the tree or, if lower down, may kill the tree. When they do not girdle the tree, recovery is usual. The injurious effect of frost may not be immediately apparent and often, in such cases, appears as if due to secondary fungi that in reality have only colonized the injured bark tissues. In this connexion the author refers to the occurrence of *Myxosporium abietinum* and *Phomopsis pseudotsugae* [*R.A.M.*, vii, pp. 482, 552] on Sitka spruce [*Picea sitchensis*] and Douglas fir [*Pseudotsuga taxifolia*] damaged by frost. Neither of these organisms acted as a virulent parasite, and they seldom spread beyond the tissue which had been killed or severely injured by the frost. They were only associated with die-back in trees already so badly affected by frost injury that recovery was impossible. In addition to these fungi on the bark of the crown, *Armillaria mellea* was sometimes also observed as a secondary parasite.

The late flushing types of the so-called late or pedunculate oak [*Quercus pedunculata*] frequently escape damage by frost, but their tendency to mildew [*Microsphaera quercina*: ibid., vi, p. 383] and defoliation precludes their general use.

[The chief points in this paper are summarized in *Quart. Journ. of Forestry*, xxii, 3, pp. 179–191, 1928.]

HUNT (G. M.). **Factors which influence the decay of untreated wood in service.**—*U.S. Dept. of Agric., Forest Products Lab. Publ.*, 7 pp., 1928. [Mimeographed.]

An account is given in popular terms of the factors conducing to decay of untreated wood used for structural purposes in the United States.

Generally speaking, wood kept constantly dry, continuously submerged in water or mud, or buried deep underground does not decay. Thus, household furniture contains too little moisture to permit of fungous growth, while submerged piling contains too little air. The scanty air supply in the soil below 5 or 6 ft. from the surface allows little decay, especially in dense, compact soils.

The rate of decay depends on the kind of fungus, the character of the wood, and its exposure to moisture and warmth. In the high altitudes of the Rocky Mountain States, rotting of posts, poles, &c., is usually confined to the soil level, whereas in the Mississippi Valley and the southern States decay frequently extends many feet above this point.

In a few species, e. g., the spruces [*Picea* spp.] and white fir [*Abies concolor*], both heart- and sapwood possess a low resistance to wood-rotting organisms, but generally, unselected timber cut from logs consisting largely of sapwood decays more readily than that taken from logs with thin sapwood.

The natural preservatives stored in the heartwood may be present in larger amounts in some trees of the same species than in others, and wide differences in this respect may even occur in different parts of a single log. In pines and Douglas firs [*Pseudotsuga taxifolia*] occasional pieces are very resinous and therefore possess exceptional durability and resistance to decay, even in contact with the ground or in other situations conducive to infection.

Wood cut and peeled in the late autumn or winter is usually less liable to immediate damage than that cut in warm weather, but infection may occur at any time in badly constructed piles or in unpeeled wood left on the ground.

Dry-rot in wood.—*Dept. of Sci. and Indus. Res., Forest Products Res. Bull.* 1, 24 pp., 6 pl., 3 diags., 1928.

In this bulletin (to which the section on the biology of fungi causing dry rot is contributed by P. Groom) the sum of the existing knowledge of dry rot is presented in a simple and practical form and directions are given for the detection, prevention, and control of the trouble. The species causing dry rot in England, viz., *Merulius lacrymans*, *Polyporus vaporarius* [*Poria vaporaria*], *Coniophora cerebella*, *Paxillus panuoides*, *Lenzites saepiaria*, *L. abietina*, and *Polyporus destructor*, are listed in a table with observations on their mode of growth, fructifications, water requirements, &c. The two chief preservative treatments recommended are the application to the surface of the wood of magnesium silicofluoride (5 per cent. solution of the acid commercial salt) and the use, either as a surface application for indoor timber or by impregnation methods out-of-doors, of tar oils, a standard specification for which is given.

Cummins (J. E.). **Discussion on timber preservation.**—*Trans. Australasian Assoc. for the Advancement of Science*, xviii (*1926*), pp. 825–831, 1928.

Wood preservation effects a saving of timber by two methods: firstly, by the prevention of decay with consequent prolongation of

life; and secondly, by facilitating the employment of the less durable species for structural purposes so that the superior durable woods are available for more valuable uses.

During the period 1909 to 1922, the total amount of timber treated in the United States is stated to have been nearly 2,000,000,000 cu. ft., of which some 80 per cent. were railway sleepers. The figures for 1922 of the relative importance of the various preservatives are as follows: creosote 60·4 per cent.; zinc chloride 32·1; zinc-creosote 7; and miscellaneous 0·5.

The only treatment extensively used in Australia is 'Powellizing', an open-tank method employing an aqueous solution containing 6 to 8 per cent. sugar and 1 to 2 per cent. arsenious oxide [*R.A.M.*, iv, p. 75]. The process consists of immersing the timber in the solution, heating at boiling-point for 7 hours, and cooling off for 40 hours. During the period 1913 to 1926, 8,046,305 cu. ft. were treated in Western Australia by this method, mainly karri [*Eucalyptus diversicolor*] and jarrah [*E. marginata*]. In the south-west of Western Australia, Powellized sleepers have been found to contract dry rot, due to the attacks of *Trametes lilacino-gilva*, in 5 to 12 years. In the hotter and drier districts, however, Powellized sleepers have proved extremely resistant not only because of the climatic conditions but also because the sparse forest stand in these regions diminishes the sources of infection. The occurrence of *Rhizoctonia* and *Heterosporium* on the exterior of Powellized wood is believed to be due to the presence of free sugar in the solution. The damage caused by these organisms is negligible, but steps should be taken to prevent their development since they may pave the way for other species.

Investigations are in progress to determine the toxicity of various compounds to *T. lilacino-gilva*, which is stated to be widely distributed in Western Australia. This fungus spreads rapidly and soon reduces the infected timber to a crumbling mass. It has been found that at low concentrations certain fungicides actually stimulated the growth of the fungus instead of retarding it: this occurred, for instance, with a 0·1 per cent. solution of zinc chloride. Impregnation of the heartwood presents considerable difficulties owing to the thickening of the cell walls and development of tyloses, which impede the penetration of the preservative fluid. Powellizing seasoned karri heartwood has given very poor results on this account.

THOMAS (R. C.) & MAGRUDER (R.). **Early Cabbage resistant to the yellows disease.**—*Bimonthly Bull. Ohio Agric. Exper. Stat.*, xiii, 4, pp. 142–144, 1 fig., 1928.

Since 1922 the Burpee's Early Forcing variety of cabbage has maintained its marked resistance to yellows [*Fusarium conglutinans*] in Ohio [*R.A.M.*, v, p. 473]. In 1926 the incidence of infection on this variety in nine different plantings ranged from 0·6 to 2·8 per cent., compared with 14·8 to 100 per cent. for a commercial strain. Attempts are in progress to develop more uniform and satisfactory types of heads in the resistant selections, after which seed will be available for general distribution.

DAWSON (MARION L.) & POVAH (A. H.). **A new Rhizopus rot of Rutabaga.**—*Science*, N.S., lxviii, 1753, p. 112, 1928.

In November, 1927, a consignment of rutabagas [swedes] at an Evanston (Illinois) greengrocer's was found to be heavily infected by a new species of *Rhizopus*, to which the name of *R. fusiformis* has been given. A wet rot develops, similar to that produced by *R. nigricans*, but *R. fusiformis* requires six days instead of three to complete its work. The new fungus was shown by inoculation tests to produce typical wet rot symptoms on carrot, cucumber, eggplant, green pepper [*Capsicum annuum*], pumpkin, Hubbard squash [*Cucurbita maxima*], onion, sweet potato, and tomato.

R. fusiformis [an English diagnosis of which is given] is characterized by a cottony mycelium, a sparse production of globose sporangia measuring 70 to 113 μ, with a spherical columella 30 to 65 μ in diameter, branched sporangiophores (1 to 2 mm. high and 13·5 to 17 μ thick) arranged in umbels of 2 to 6 and sometimes branched again, with a fusiform swelling at the base of the insertion of the branches, and pale grey, subglobose to suboval spores, measuring 5 to 7 by 3·5 to 7 μ. The new species presents certain analogies with *R. nodosus* and *R. arrhizus*, differing from the former, however, in the shape and location of the mycelial swellings, and from the latter in sporangial dimensions and the production of swellings.

DAFERNER (C.). **Meltau-Bekämpfung in Gemüsekulturen.** [Mildew control in vegetable cultures.]—*Obst- und Gemüsebau*, lxxiv, 8, p. 127, 1928.

Excellent results in the control of tomato and kohlrabi [*Brassica oleracea* var. *caulorapa*] mildew [*Cladosporium fulvum* and *Erysiphe polygoni*, respectively] are stated to have been obtained by spraying with 1 per cent. erysit [*R.A.M.*, vi, p. 305].

BREMER (H.). **Die Herzfäule der Steckrübe.** [Heart rot of the Turnip.]—*Illus. Landw. Zeit.*, xlviii, 31, pp. 400–401, 1 fig., 1928.

For the last two years turnips in Schleswig-Holstein have been attacked by a heart rot, which in one field affected 80 per cent. of the plants and reduced the yield by 50 per cent. Judging by various reports this was not an isolated case. The disease was found to be caused by bacteria which enter the plants through wounds inflicted by the insect *Contarinia nasturtii*. The incidence of heart rot may be minimized by relatively late sowing, and by the selection of sites at a distance from fields planted to turnips in the previous year.

HAENSELER (C. M.). **Effect of organic mercury seed treatments on germination and yield of Peas.**—*Forty-eighth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1927*, pp. 232–238, 1928.

During the past two years a number of greenhouse and field tests [the results of which are described and tabulated] have been conducted to determine the value of various organic mercury com-

pounds applied to the seed as control measures against seed decay, root rots, and other pea diseases.

It was found that the treatment of pea seed with organic mercury compounds in dry form caused no reduction of germination, whereas the use of mercury solutions or water sometimes produced this effect, probably through mechanical injury in the handling of the swollen seeds.

Dusting the seed with various types of Du Pont semesan (containing 35 per cent. hydroxymercurichlorophenol sulphate) and Bayer dip dust (6 per cent. hydroxymercurichlorophenol sulphate and 2 per cent. hydroxymercurinitrophenol sulphate) at the rate of 2 or 3 oz. per bushel gave increases in germination ranging from 1·5 to 11 per cent. in four out of five tests. These effects were particularly marked in a soil heavily infested with *Pythium* and other seed-rotting organisms. *Ascochyta* [*pisi*, *A. pinodes*, and *A. pinodella*: *R.A.M.*, vii, p. 611] was not controlled by these treatments.

NOVINENKO (A. I.). Насекомые, как переносчики мозаичной болезни Сахарной Свеклы. (Предварительное сообщение.) [Insects as carriers of the mosaic disease of Sugar Beet. (Preliminary report.)]—*Protection of Plants in Ukraine, 1927–8*, 3–4, pp. 164–168, 2 figs., 1 graph. [Received November, 1928.]

The first year's results of investigations started in 1927 by the Entomological Section of the Kharkoff [Ukraine] Regional Agricultural Experiment Station, to determine what insects were responsible for the spread of sugar beet mosaic, showed that this disease is carried by *Aphis fabae* [*A. rumicis*], *Poeciloscytus cognatus*, *Euscelis striatulus*, *Cicadula sexnotata*, and *Orthotylus flavisparsus*. In the experiments [details of which are given] mosaic was transmitted in 100 per cent. of the tests only by the aphids, while with the other insects listed successful infection (as manifested by the symptoms at harvest time) followed in only 20 to 40 per cent. of the inoculated seedlings. It was, however, noticed that many of the seedlings showed transient symptoms of mosaic soon after inoculation, but recovered entirely subsequently, the inference being that infection in such plants was latent and might reappear in their second year of growth. The fact that under natural conditions only 6 per cent. of the beets in the field were usually found to be infested with aphids in early spring, and also that in his experiments the aphids were transported in entire colonies on to the test plants, while only three individuals of the larger insects were placed on each plant, leads the author to believe that in nature the latter are the more active and successful carriers of mosaic, the more so since their mobility in the crop is much greater than that of the aphids.

CARTER (W.). **Transmission of the virus of curly-top of Sugar Beets through different solutions.**—*Phytopath.*, xviii, 8, pp. 675–679, 1928.

In continuation of his previous experiments in connexion with curly top of sugar beets [*R.A.M.*, vii, p. 3], the writer succeeded in

transmitting the disease by means of previously non-infective leafhoppers (*Eutettix tenella*) which had fed on a solution containing twelve crushed infective leafhoppers, 0·4 per cent. soluble starch, and 40 c.c. of distilled water. It was further transmitted by leafhoppers fed on a solution of one drop of diseased beet juice in 40 c.c. of a 1 per cent. sucrose solution kept at 85° for four days. Positive results were also obtained with leafhoppers fed on various sugar solutions (containing dextrose, maltose, glucose, sucrose, lactose, and raffinose in different combinations) on which a large number of infective individuals had previously fed, but the incubation period of the disease was generally a good deal longer in such cases.

SEVERIN (H. H. P.) & SWEZY (OLIVE). **Filtration experiments on curly top of Sugar Beets.**—*Phytopath.*, xviii, 8, pp. 681–690, 1 pl., 2 figs., 1928.

Various methods devised by the authors and others for feeding leafhoppers on the expressed juice of beets are described [see preceding abstract]. Non-infective beet leafhoppers (*Eutettix tenella*), fed on root juice expressed from curly top beets and filtered through coarse, medium, and fine Berkefeld candles, were found to transmit the disease to healthy plants. A rapid inactivation of the virus, probably associated with chemical changes in the root juice (oxidation and fermentation processes) begins after the first day.

Non-infective leafhoppers, after feeding on a culture medium of healthy beet juice and 5 per cent. sugar containing infective individuals macerated after 24 hours' fasting to ensure the evacuation of the digestive canal (thus avoiding the transmission of unchanged juice), the whole being then centrifuged and filtered through a fine Berkefeld candle, transmitted curly top to healthy beets.

It is evident from these experiments that a filterable stage of the curly top virus occurs both in beets and in the insect vector.

SEVERIN (H. H. P.) & HENDERSON (C. F.). **Some host plants of curly top.**—*Hilgardia*, iii, 13, pp. 339–384, 4 pl., 24 figs., 1928.

The following field and garden plants have been found to show natural infection with curly top in California [see preceding abstracts]: sugar beets and other strains of *Beta vulgaris*, *B. maritima*, spinach, field and garden beans (*Phaseolus vulgaris*), Lima beans (*P. lunatus*), cowpeas, lucerne, *Cucurbita pepo*, *C. maxima*, *C. moschata*, watermelon, cucumber, and *Cucumis melo* (muskmelons and cantaloupes), besides a number of weeds and shrubs belonging to the Chenopodiaceae [*R.A.M.*, vii, p. 691].

Successful inoculation experiments were carried out with curly top on a number of the above-mentioned hosts, in addition to horse beans (*Vicia faba*), three species of vetch (*V. sativa*, *V. atropurpurea*, and *V. villosa*), chick pea (*Cicer arietinum*), three species of *Melilotus* (*M. hispida*, *M. alba*, and *M. indica*), and four of *Trifolium* (*T. repens*, *T. hybridum*, *T. incarnatum*, and *T. pratense*).

Details are given concerning the development of the symptoms and the longevity of *Eutettix tenella* on the various hosts.

SEVERIN (H. H. P.). **Transmission of Tomato yellows, or curly top of the Sugar Beet, by Euttetix tenellus (Baker).**—*Hilgardia*, iii, 10, pp. 251–271, 2 pl., 8 figs., 1928.

The results of experiments conducted under controlled conditions [which are fully described] showed that the beet leafhopper, *Eutettix tenella*, transmits tomato yellows or curly top to tomatoes [*R.A.M.*, vii, p. 478]. Tomatoes inoculated with the curly top virus from beets by means of infective leafhoppers developed typical symptoms of yellows in the field. Non-infective insects, after feeding on infected tomatoes, were transferred to healthy sugar beets and typical symptoms of curly top were produced. The disease was also transmitted from naturally infected tomatoes to sugar beets.

Tomatoes grown under glass were susceptible to curly top, but the typical symptoms of yellows failed to develop on caged plants. Where cages were not used, mild symptoms of yellows appeared in inoculated tomatoes. One of the most reliable symptoms of sugar beet curly top, namely, the clearing or transparency of the veinlets, developed in tomatoes inoculated with the disease in the greenhouse but not in the field, and it did not occur in naturally infected plants.

The incubation period of the disease on tomatoes in the field ranged from 16 to 26 days during the spring.

Curly top was also transmitted from tomatoes showing only mosaic symptoms in a field where both diseases were present, thus demonstrating that the plants were doubly infected.

SJÖGREN (H.). **Vad bör göras för att motverka rotbrand ?** [What must be done to combat root rot ?]—*Landtmannen*, xi, 33, p. 659, 1 fig., 1928.

Both Swedish and foreign observations have shown that root rot of beet (*Phoma betae*, *Pythium de Baryanum*, and *Aphanomyces levis*) is most prevalent on soils with a deficiency of lime and a tendency to incrustation [*R.A.M.*, vi, p. 72]. The incidence of infection may be greatly reduced by thorough drainage and liming of the soil; a plentiful and well-balanced supply of fertilizers; prevention of crust formation; moderately shallow sowing; use of superior selected seed; and six- to. eight-yearly crop rotation, avoiding the immediate alternation of beet with oats, barley, clover, lucerne, and the like. The efficacy of seed treatment is considered to be dubious, since only *P. betae* is controllable by this means.

PULSELLI (A.). **Un grave caso di tracheomicosi del Carciofo.** [A serious case of tracheomycosis of Artichoke.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 2, pp. 189–193, 1928.

In April, 1928, a wilt disease of artichokes [*Cynara scolymus*] killed about one-third of the plants in a large plantation near Rome. The disease, which was reported to have been present in a mild form in 1927, was characterized by a withering of the green parts in the early spring, due to the presence of a fungus in the vascular tissues, especially the peripheral vessels. The mycelium was found in all parts—roots, stem, leaf sheaths, leaf veins, and

stalk of the inflorescence—but the lateral roots sometimes escaped infection and new roots seemed to be formed for a considerable time after attack, accompanied by the development of late shoots from the base of the plant.

From the affected plants the author isolated a fungus which formed a greenish-brown mycelium on carrot agar, darkening with age. Small, hyaline, unicellular conidia were produced in the cultures in great quantities on short, hyaline conidiophores, while groups of large brown cells, resembling chlamydospores, developed in the dark mycelium, turning it almost black. Further investigations to determine the identity and pathogenicity of this fungus are in progress.

VEREȘCEAGHIN [VERESCIAGHIN] (B.). **Dușmanii Viilor din Basarabia.** [Enemies of the Vine in Bessarabia.]—*Viața Agric.*, *1928*, 12, pp. 373–380, 1928.

Brief popular descriptions are given of the principal insect and fungous parasites, and physiological diseases, of the vine prevalent in Bessarabia, together with recommendations for their control. All the fungal diseases dealt with in this paper have already been noticed from a previous communication of the author [*R.A.M.*, vi, p. 206].

HENGL (F.). **Vergleichende Versuche gegen pilzliche Rebenschädlinge in den Jahren 1925 bis 1927.** [Comparative experiments in the control of fungous pests of the Vine during the years 1925 to 1927.]—*Allg. Weinzeit.*, xlv, 15, pp. 227–234, 1928.

For many years past the Vienna Plant Protection Institute has undertaken, in co-operation with various other bodies and individual growers, a series of tests of various preparations for the control of downy mildew of the vine (*Peronospora* [*Plasmopara*] *viticola*) [*R.A.M.*, v, p. 77]. As in most previous years, the best control in tests conducted in various parts of Austria from 1925 to 1927, inclusive, was given by Bordeaux mixture, five applications of a mixture containing 1·5 per cent. copper proving most efficacious. A number of other preparations used in the tests, including Horst dust (5 and 8 applications), verdola, pulvarsol, P.1. and P. S. pastes (Chinoin), Teller's copper-lime dust, tenax, and nosprasit (5 applications), gave more or less unsatisfactory results. Bosna paste, perosan, nosprasen, cusisa, cusarsen, petebe [ibid., viii, p. 14], antinospra A and B, and funguran were somewhat better, but cannot be recommended as substitutes for the standard treatment. *Oidium* [*Uncinula necator*] was best controlled by dusting with ventilato sulphur, applied immediately after the spraying with a copper sulphate mixture against downy mildew.

CAPUS (J.), VIALA (P.), RABATÉ (E.), & GERVAIS (P.). **La teneur en cuivre des bouillies.** [The copper content of mixtures.]—*Rev. de Vitic.*, lxix, 1777, pp. 37–44, 1928.

At a meeting of the Academy of Agriculture, Montpellier, Capus reviewed the results obtained from the experiments conducted during 1927 by the Institute of Agricultural Research [*R.A.M.*,

viii, p. 12] to test the proportion of copper sulphate required to give adequate control of vine mildew [*Plasmopara viticola*]. The conclusions were confirmed by Viala, who insisted, however, that when conditions favour infection liquid treatments must be combined with cupric dust applications. Rabaté added that for 30 years he had secured satisfactory control of *P. viticola* by five applications of a neutral or slightly alkaline Bordeaux mixture containing 2 kg. copper sulphate per 100 l., and two or three applications of alkaline dust composed of 4 parts hydraulic lime, 3 parts flowers of sulphur, 2 parts wood ashes, and 1 part cupric powder.

UPPAL (B. N.). **India: fungous diseases of the Grape in the Bombay Presidency.**—*Internat. Rev. of Agric.*, N.S., xix, 8, p. 745, 1928.

The only new vine disease recorded in the Bombay Presidency during 1926 was root rot caused by *Dematophora* [*Rosellinia*] *necatrix*, which failed to yield to any of the treatments applied for its control.

MERCURI (S.). **Un'esperienza sopra l'azione dei prodotti del ricambio e dell' estratto del micelio di 'Rosellinia necatrix' sopra le radici di Vite.** [An experiment on the action of the metabolic products and mycelial extract of *Rosellinia necatrix* on Vine roots.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 2, pp. 194–199, 1928.

Experiments are briefly described in which the roots of young vine plants about 20 days old were exposed to the action of liquid (either unheated or previously exposed to a temperature of 100° C. for ten minutes) taken from a culture on carrot decoction of *Rosellinia necatrix* isolated from artichoke roots [*Cynara scolymus*] and were then kept at room temperature (13° to 18°) for 76 days. Other roots of vines about three months old were similarly treated with heated and unheated fresh mycelial extract of the fungus, and kept at room temperature for 30 days.

In the plants treated with the unheated mycelial extract the hypocotyl was much discoloured towards the top, the tissues were necrosed, the protoxylem discoloured, and some of the medullary cells contained a yellow-brown tannic precipitate. The roots were much discoloured, and the endodermis and some cells in the inner layer of the primary cortex contained abundant dark albuminous-tannic precipitates, which the author considers resulted from the killing of the cells by toxins in the mycelium.

The heated mycelial extract slightly discoloured the top of the hypocotyl, and discoloured the tissues of the protoxylem and medulla, but precipitation was less abundant than in the plants exposed to the unheated extract. The roots were slightly discoloured, but their tissues appeared otherwise normal, and the endodermis was colourless.

The unheated culture liquid caused a slight discoloration of the hypocotyl under the cotyledons, but the roots remained normal. The heated culture liquid produced no change.

These results are considered as tending to confirm Picado's view [*R.A.M.*, iii, p. 473] that the toxins of parasitic fungi usually are present only within the mycelium.

Control of the anthracnose of Grape.—*Bombay Dept. of Agric. Leaflet* 1 [of *1928*], 3 pp., 1 pl., 1928.

A brief, popular account is given of the symptoms of vine anthracnose [*Gloeosporium ampelophagum*] and of the conditions of low temperature and high humidity favouring its development in the Bombay Presidency. Directions are given for the control of the disease by pruning off the diseased wood and two applications of 5–5–50 Bordeaux mixture (1) when the new shoots are 8 to 12 inches long (in May); and (2) late in July or at the beginning of August when 2 lb. of resin-fish-oil soap per 50 galls. should be added to improve the adhesiveness of the mixture during the rainy monsoon weather. Vines that have been badly attacked during the rains should not be pruned before the first week of October, as they are liable to damage if there are late rains after that date.

RAVAZ (L.), LAGATU [H.], & MAUME. **Un cas spécial de chlorose des Vignes américaines greffées.** [A special case of chlorosis of grafted American Vines.]—*Ann. École Nat. d'Agric. Montpellier*, N.S., xix, 3, pp. 159–179, 1 col. pl., 1928.

Details are given of a biochemical investigation of various organs of the American grafted vines at the École Nationale d'Agriculture at Montpellier, which was made with a view to finding an explanation for the peculiar form of chlorosis described by the senior author [*R.A.M.*, vii, p. 490] from which some of them suffer in certain years. The results indicated that this condition was most probably caused by a transient deficiency in iron in the affected organs in years when the preceding winter and spring were marked by insufficient rainfall. This view is supported by the fact that the Rupestris du Lot variety used as a stock normally contains less iron than the corresponding organs of the varieties used for scions, when they are grown on their own roots, so that the former is unable, when used as a stock, to supply the iron needs of the latter in dry years. It is, therefore, believed that there exists an incompatibility between the stock and scion, which is the real cause of the chlorosis.

SMARODS (J.). **Materiali Latvijas mikoflorai.** [Materials towards the mycoflora of Latvia.]—*Rept. Latvian Inst. Plant Protect. 1927–28*, pp. 8–9, 1928.

Among the items of interest in this list of fungous diseases observed in Latvia during the period from 1st May, 1927, to 1st May, 1928 [cf. *R.A.M.*, vii, p. 558], the following may be mentioned. *Betula pubescens* was attacked by *Plowrightia virgultorum*; *Phormium tenax* by *Physalospora phormii*; *Fragaria* sp. by *Septogloeum fragariae*; and *Fraxinus excelsior* by *Fusicladium fraxini*.

SUNDARARAMAN (S.). **Administration Report of the Government Mycologist, Coimbatore, for 1927–28.**—*Rept. Dept. of Agric., Madras, for the year 1927–28*, pp. 355–372, 1928.

The E.B. 24 and Co. 1 varieties of rice again showed a relatively high degree of resistance to blast (*Piricularia oryzae*) [*R.A.M.*, viii, p. 17] as compared with Korangu Samba.

The maximum spread of sugar-cane mosaic [ibid., viii, p. 62] was found to take place between the third and fifth months of growth. The P.O.J. 2714 variety remained immune. The virus was successfully transmitted by hypodermic injections and also by placing plugs of diseased cane tissue in setts used for planting.

Further investigations were carried out on the boll rot and seedling blight of cotton caused by *Vermicularia* sp. [ibid., viii, p. 18]. The pathogenicity of the fungus was demonstrated by inoculations on the cotyledons, leaves, and collar.

An attempt was made to find a substitute for Bordeaux mixture for spraying pepper [*Piper nigrum*] vines attacked by the 'pollu' disease, since this preparation destroys the parasitic fungi which normally check the spread of mealy bugs. However, neither Burgundy mixture nor lime-sulphur proved equal to Bordeaux in the control of pollu. Hitherto this disease has been considered responsible for most of the immature spike fall among the west coast pepper crops, but recent researches indicate that the losses from pollu have been much exaggerated, and that other factors are involved in the etiology of the important spike fall problem.

A serious disease of betel [*P. betle*] vines was reported from the Chingleput district. A species of *Phytophthora* was found to be causing a rot of the underground portions with consequent wilting, while *Sclerotium rolfsii* attacks the collar region and gradually spreads through the entire plant [cf. ibid., vii, p. 303]. The disease is thought to be favoured by the almost complete absence of crop rotation and by the copious irrigation practised.

The epidemic occurrence of *Rhizoctonia bataticola* [*Macrophomina phaseoli*] on groundnuts was observed only in the irrigated crop. The sclerotia of the fungus were found to retain their viability for 15 months when buried in pots of dry soil at depths ranging from 1 to 6 inches.

The unsuccessful results of recent experiments in the control of mulberry mildew [*Phyllactinia corylea*] in the Coonoor district show that the production of a healthy crop of leaves between May and December is impracticable. It may be possible, however, to minimize the virulence of the attack sufficiently to obtain an adequate supply of leaves for silkworm feeding.

Thielaviopsis paradoxa, the causal organism of the stem bleeding disease of coco-nut and areca nut [*Areca catechu*] palms [ibid., vii, p. 629], was found to produce similar symptoms on Palmyra palms [*Borassus flabellifer*]. Inoculation experiments on healthy young Palmyra palms with a pure culture of the fungus from a diseased palm resulted in the death of the plants within a month. Successful inoculation tests were also performed on coco-nut, areca palm, sugar-cane, and pineapple with the Palmyra palm strain of *T. paradoxa*.

During 1927 the number of Palmyra palms eradicated on account

of bud rot [*P. palmivora*: ibid., viii, p. 17] was 9,434 compared with 14,518 in 1926.

A species of *Fusarium* isolated from the rhizome of a plantain [*Musa paradisiaca*] affected by wilt in Madura was found to agree closely with the causal organism of Panama disease [*F. cubense*].

A number of three-year-old *Cinchona* plants at the Government plantation, Anamalai, were found to be dying from collar rot caused by *Rosellinia* sp. and *Fomes lamaoensis*, while nursery seedlings were suffering from a damping-off due to *Rhizoctonia* sp.

A serious case of orange mildew [? *Oidium tingitaninum*: ibid., vii, p. 675] was reported from an estate on the Shevaroys. Bordeaux mixture gave the best results of all the fungicides tested for the control of this disease.

FERRARIS (T.). **Agricoltura e fitopatologia nel Kashmir.** [Agriculture and phytopathology in Kashmir.]—*Curiamo le Piante !*, vi, 5, pp. 81–86, 1928.

In an interview with the author, Mr. M. R. Fotidar, of the Agricultural Department, Srinagar, India, gave some interesting details of the diseases of cultivated crops prevalent in Kashmir. As the climate favours infection and the cost of copper sulphate is prohibitive, vines are much subject to attack by *Peronospora* [*Plasmopara viticola*] and *Oidium* [*Uncinula necator*]. Peaches suffer from leaf curl (*Exoascus* [*Taphrina*] *deformans*), brown rot (*Monilia* [*Sclerotinia*] *cinerea*), and chlorosis. *Puccinia graminis* is prevalent on wheat in wet areas or where *Berberis* bushes are common, while *P. glumarum* and *P. triticina* attack wheat in the drier parts of the country, and loose smut (*Ustilago tritici*) and bunt (*Tilletia tritici*) are also found. *U. avenae* is common on oats and *U. maydis* [*U. zeae*] on maize.

[EDWARDS (W. H.)]. **Botanical Division.**—*Ann. Rept. Mauritius Dept. of Agric. for the year 1927*, pp. 17–19, 1928.

The following items of phytopathological interest, other than those already noticed, are included in this report. On seven estates the leaves of the R.P. 8 variety of sugar-cane were found to be affected by streak, which also occurred on various grasses [*R.A.M.*, vii, p. 14]. Outbreaks of red rot of sugar-cane [*Colletotrichum falcatum*] generally appear to be secondary to infestation by moth borers [*Diatraea saccharalis*] under Mauritius conditions. Notes are given on the increasing prevalence of gummosis [*Bacterium vascularum*: see above, p. 65], which, it is believed, may predispose tolerant sugar-cane varieties to the development of root rot; the latter is usually observed only where the physical conditions of the soil are unsuitable for normal growth.

Preliminary investigations on a bud rot of coco-nuts indicate that the disease is caused by a bacterium of the genus *Eberthella*.

A new disease of filao [*Casuarina equisetifolia*], characterized by the peeling of the bark around the main stem and on a few lateral branches of young trees, was observed in several districts during the latter part of the year.

Other diseases observed were the bacterial and sclerotial wilts of groundnuts [*Bact. solanacearum* and (?) *Sclerotium rolfsii*, respectively], tomato septoriosis [*Septoria lycopersici*], and bacterial wilt of tomato [*Bact. solanacearum*].

Plant diseases.—*Fortieth Ann. Rept. Georgia Agric. Exper. Stat. for the year 1927*, pp. 20–23, 1 fig., 1928.

In addition to items already noticed in this *Review* from other sources the following are of interest. The development of the perfect stage of the grape leaf blight fungus (*Cercospora viticola*) is stated to correspond in essentials with that of *Mycosphaerella bolleana* [*Amer. Journ. of Bot.*, vii, p. 436, 1920].

Most of the F_1 progeny, comprising 75 seedlings, of a cross between Burpee and Globe tomatoes proved more susceptible to wilt (*Fusarium lycopersici*) than either of the parents. More than half the plants died before 1st July without setting fruit, and only five (four of which were infected in the stems and roots), remained alive till the end of the growing season.

The F_1 seedlings from seed of two partly rosetted peach trees have grown for two years without developing any symptoms of the disease, indicating that infection is not seed-borne [*R.A.M.*, vi, p. 400].

None of the chemicals applied to the soil round the base of pepper [*Capsicum annuum*] plants, viz., mercuric chloride, calcium arsenate, lead arsenate, and sodium borate, proved effective in the control of *Sclerotium rolfsii* [ibid., vii, p. 48], the damage from which is stated to be steadily increasing. A black discoloration and decay of the seed-cavity of Pimento pepper fruits, which caused heavy losses to the canning trade during the period under review, was found to be due to the penetration of *Macrosporium*, *Penicillium*, and other moulds through the old pistil remaining at the blossom-end.

Botany.—*Forty-first Ann. Rept. Pennsylvania Agric. Exper. Stat. for the fiscal year ending June 30, 1928* (*Bull.* 230), pp. 17–20, 1 fig., 1928.

This report contains the following items of phytopathological interest. *Mycogone perniciosa* in mushroom beds was well controlled by treatment of the soil with a 1 in 25 solution of formaldehyde, which also acted as a moderate stimulant to production [*R.A.M.*, vii, p. 142]. Carbon disulphide emulsion (1 in 25) was less effective in the control of *M. perniciosa*, but gave a greater stimulus to mushroom production than formaldehyde.

During the summer of 1927 apple scab [*Venturia inaequalis*] was prevalent, occurring on 88 per cent. of the fruit on untreated trees. The best control was observed on the plots receiving the standard lime-sulphur spray and 80–10–10 sulphur dust, which showed 5·1 and 5·8 per cent. infection, respectively. During the nine-year period of apple scab observations, such good results with dusts have been exceptional.

Observations on the perennation of the larch-willow rust [*Melampsora bigelowii*] showed that this fungus is capable of a continuous existence on willow, on which the uredo stage develops

annually from the mycelium in the wood. In basket willows [*Salix discolor*], at any rate, infection eventually causes the death of the host.

Tobacco seedlings have been found to be very tolerant of applications of organic mercury compounds, which cause a considerable stimulation of growth. The application of these preparations to centres of wildfire [*Bacterium tabacum*] infection in seed-beds arrested the spread of the disease and in some cases apparently destroyed the parasite. Formaldehyde treatment of seed-bed soil was found to cause a marked improvement in the growth of tobacco seedlings [ibid., v, p. 332].

Division of Botany.—*Forty-seventh Ann. Rept. New York (Geneva) Agric. Exper. Stat. for the fiscal year ended June 30, 1928*, pp. 32–38, 1928.

In addition to items already noticed from other sources, this report contains the following items of phytopathological interest. Two seasons' records in a large planting of Plum Farmer raspberries affected by the red raspberry, yellow, and mild mosaic diseases and by streak [*R.A.M.*, vi, p. 675] have shown wide variations in the degree of injury and type of symptoms in each of these diseases. Red raspberry and yellow mosaic have spread rapidly in the planting, generally causing severe injury, and both these diseases are becoming more prevalent in commercial black raspberry [*Rubus occidentalis*] plantings.

Attempts to rejuvenate apple and pear trees suffering from root diseases [ibid., v, p. 499] by the use of nitrogenous fertilizers and pruning top growth are stated to be giving promising results. On the other hand, bridge grafting of crown-injured trees has been less successful during the past two years than formerly.

The incidence of the apple scab fungus [*Venturia inaequalis*] was found to vary widely during the past five seasons. Both in 1927 and 1928 the organism overwintering on fallen leaves provided scant inoculum during the early stages of apple growth. The best control of scab has been given by lime-sulphur and bordo-oil for the early, and lime-sulphur and New Jersey dry-mix sulphur-lime [ibid., v, p. 311] for the late applications. Severe russeting was caused in 1928 by lime-sulphur, and by copper fungicides both in 1927 and 1928.

ULTÉE (A. J.). **Verslag over de werkzaamheden van het Proefstation Malang in het jaar 1927.** [Report on the work of the Malang Experiment Station in the year 1927.]—*Meded. Proefstat. Malang*, 67, 48 pp., [1928].

The following scattered references of phytopathological interest are contained in this report. From the end of August till the middle of November investigations were conducted on the etiology of the die-back disease of coffee previously reported [*R.A.M.*, v, p. 475], for which the name of 'top die-back' is proposed as more descriptive. This disease appears to be a tracheomycosis associated with the presence of fungi in the wood-vessels. A detailed account of the results of these studies is in preparation. The economic

importance of the coffee die-back in the Palembang and Benkoelen Residencies is stated to be considerable.

A sporadic coffee disease characterized by splitting of the bark is thought to be probably of physiological origin. Healthy trees could not be infected by contact with diseased bark.

Attention is drawn to the presence of mildew [*Oidium heveae*: ibid., vii, p. 598] on the inflorescences of rubber trees, unaccompanied by any attack on the leaves.

Paranitrophenol (0·5 to 1 per cent.) [ibid., v, p. 694 *et passim*] has proved a valuable disinfectant for the prevention of mould on sheet rubber.

Němec [B.]. **Über Pflanzentumoren.** [On plant tumours.]—*Arch. für Exper. Zellforsch.*, vi, pp. 172–177, 1928. [Abs. in *Bot. Centralbl.*, N.S., xiii, 7–8, p. 249, 1928.]

The crown gall tumours induced by *B[acterium] tumefaciens* are stated to occupy a special position among cancerous growths on plants. They are of endogenous origin and generally of simpler structure than the organ on which they develop. The nuclear and cell divisions are characterized by irregularities which may result in polyploid nuclei and pluri-nuclear cells. Since, however, external stimuli, e. g., benzine fumes, may produce similar abnormal effects, these are regarded as secondary phenomena. The bacteria evidently stimulate the division of the host cells by the products of their metabolism. Magnus found in 1915 that wound callus in the sugar beet developed more prominently on the parts smeared with a culture of *Bact. tumefaciens*. The writer, in similar tests, has not observed the penetration of the bacteria into the interior of the unwounded cells. The tumours caused by *Bact. tumefaciens* differ from those of human cancer in various ways, especially in maturing like galls and in the limited divisional capacity of their cells.

Giovanni (A.). **Sarcoma a cellule fusate in un pesce iniettato con il Bacterium tumefaciens.** [Fusoid sarcoma in a fish inoculated with *Bacterium tumefaciens*.]—*Arch. Sci. Med.*, Turin, lii, 9, pp. 481–495, 6 figs., 1928.

On 3rd June, 1927, a fish (*Carassius vulgaris*) was inoculated with *Bacterium tumefaciens* on the left side. On its death six months later, a soft tumour, presenting a red and white marbled appearance, was found to have developed on the left ventral fin. The histological examination of the tumour showed that it consisted of fusiform elements. Cultures of the organism isolated from this proliferation were inoculated into young, fleshy leaves of *Agave salmiana* with positive results.

Rivera (V.). **Azione di forti dosi di raggi γ sopra il 'B. tumefaciens' Smith et Townsend.** [The action of strong doses of γ rays on *Bacterium tumefaciens* Smith & Townsend.]—*Rendic. Accad. Lincei*, vii, Ser. 6, 10, pp. 867–869, 1928.

Continuing his earlier experiments [*R.A.M.*, vii, p. 146], the author exposed ten-hour-old pure cultures of *Bacterium tumefaciens* for six days at distances of 6 and 20 cm., respectively, to

the gamma rays emitted by 0·6 gm. of radium. One day later, bacterial development had occurred both in the exposed cultures and the controls, but the former appeared to be more vigorous.

On 23rd April, 1928, three one-day-old cultures of *Bact. tumefaciens* were exposed for six days at an average distance of 5 cm. to the gamma rays emitted by 1 gm. of radium, two other series being similarly exposed for two days and one day, respectively, while a third consisted of unexposed controls.

On 26th April the controls and the cultures exposed for one day showed abundant bacterial development, though none was noted in the remaining series. Three days later, some development was also noted in the cultures exposed for two days, while on 1st May the series exposed for six days showed incipient development in the part of the medium farthest removed from the rays. Later, bacterial development was almost as abundant in all the exposed series as in the controls, and inoculations of *Ricinus* [*communis*] with cultures from each series gave positive results.

BREGA (C.). **Ulteriori osservazioni sopra l' influenza della semina sullo sviluppo della ruggine dei cereali.** [Further observations on the effect of the date of sowing upon the development of cereal rust.]—*Riv. Pat. Veg.*, xviii, 7–8, pp. 153–160, 1928.

In continuation of previous investigations [*R.A.M.*, vii, p. 80], wheat of different varieties was sown in experimental plots at Villamarone, Voghera, and Certosa, in the vicinity of Pavia, during the season 1927–1928.

The autumn was wet and the winter rather cold, with a little snow in December, January, and March.

In most cases the first rust observed was *Puccinia glumarum*, this being frequently followed by *P. graminis* and *P. triticina*; though sometimes the first infection was by *P. graminis* alone or together with *P. triticina*.

Observations in the experimental plots [which are tabulated] and in the surrounding country showed that the most resistant varieties were Todara 96, Italo Giglioli, Virgilio, Mentana, Rieti, and Marzuoli var. Manitoba; the most susceptible were Nostrano, Gentil Rosso, and Marzuoli var. Ferrarese. No significant difference in susceptibility was observed between wheat grown from seed taken from the 1926 crop and that from the 1927 crop. Early sowing again appeared to conduce to early infection [loc. cit.], but the severest attacks took place on wheat sown late in the season. It is considered that for infection to take place the plant must have reached but not passed through a certain stage of development, which may be related to osmotic tension in the tissues [ibid., vii, p. 769], while a sufficiently high temperature is also necessary.

In March and April, 1928, the author observed uredosori of rusts in active development on *Lolium temulentum* and *Cynodon dactylon*; in a foot-note Montemartini states that this confirms his opinion that in the Po valley certain species of *Puccinia* can overwinter in some years in the uredo stage.

MILAN (A.). **Il grado di recettività per la 'carie' delle varietà de Frumento (ii Nota).** [The degree of susceptibility to bunt of Wheat varieties (2nd note).]—*Nuov. Giorn. Bot. Ital.*, N.S., xxxiv, 5, pp. 1188–1199, 2 graphs, 1928.

In continuation of the author's earlier investigations [*R.A.M.*, iv, p. 272], wheat of nine different named varieties was sown in the open during 1924 and 1925 in order to test varietal susceptibility to bunt [*Tilletia tritici* and *T. levis*] at different sowing dates.

The results obtained [which are tabulated, expressed graphically, and fully discussed] showed that all the varieties, whether sown early or late, were least susceptible when the air temperatures prevailing during germination were either very high or very low [ibid., iii, p. 511]. At average temperatures of 5·5°, 6·7°, 2°, and 3·2° C., the average percentage infections for all the varieties were, respectively, 19·95, 19·05, 13, and 12·3 as compared with only 0·3 and 0·64 for temperatures at 20·5° and 10·5°, respectively. With Rieti wheat the percentage infection varied from 1 at 20·5° and 2·5 at 10·5° to 21·5 and 28 at 5·5° and 6·7°, respectively.

In the series sown on 25th September, 1924, and 6th March, 1925, even the most susceptible varieties remained almost unaffected though the average prevailing temperatures were, respectively, 20·5° and 10·5°. As the latter is not considered high enough to afford protection to the developing seedling in its earliest stages and as soil conditions also favoured the germination of the spores, the author suggests that the comparative immunity at this temperature resulted from the shortening of the vegetative stages of the growth of the host so that the parasite, though it had succeeded in entering the plant, was unable to keep pace with its growth and failed to reach the ears.

The two most susceptible of the varieties tested were Carlotta Strampelli and Luigia Strampelli, while Dauno was practically immune (1·4 per cent. infection) and Apulia and Cologna highly resistant. Gentil Rosso mutico, Rieti, Massy, and Gregorio Mendel were intermediate in their reaction to infection.

FLORIMOND-DESPREZ. **A propos des batteuses à grand travail et le traitement à sec des Blés contre la carie.** [Note relative to mechanical threshers and the dusting of Wheat against bunt.] —*Comptes rendus Acad. d'Agric. de France*, xiv, 28, pp. 980–982, 1928.

Continuing his investigations on the relative merits of steeping and dusting wheat seed-grain for the control of bunt [*Tilletia tritici* and *T. levis*: *R.A.M.*, vii, p. 311], the writer has studied the effects of these treatments on the germination of grain threshed by machinery and otherwise. It was found that the copper sulphate treatment invariably reduced germination (up to 52, 66, and 68 per cent.), the injurious effects being more noticeable in the machine-threshed grain. By immersing the seed-grain in milk of lime after disinfection the adverse action of the copper sulphate was largely counteracted and germination increased to between 94 and 97 per cent. Dusting [with copper oxychloride: loc. cit.] caused practically no reduction of germination (98 to 100 per

cent.). The influence of these treatments on the incidence of bunt could not be studied in the almost complete absence of the disease.

FRIEDRICHS (G.). **Ein neuer Trockenbeizapparat für kontinuierliche Arbeitsweise.** [A new dusting apparatus for the continuous mode of operation.]—*Deutsche Landw. Presse*, lv, 39, p. 568, 1 fig., 1928.

Full details are given of the construction and mode of application of the Neusaat-Trockenbeizer Modell C (F. Neuhaus, Eberswalde), a new continuous disinfection apparatus for the dusting of seed-grain [cf. *R.A.M.*, vii, p. 436]. The machine was found to fulfil all the necessary requirements, and may be recommended for use on an extensive scale, e. g., in cereal breeding institutions, cooperative societies, large estates, and the like.

HANKE (K.). **Wie schützen wir unsere Saaten vor Krankheiten?** [How shall we protect our seed-grain from diseases?]—*Illus. Landw. Zeit.*, xlviii, 37, pp. 472–473, 3 figs., 1928.

The writer has obtained excellent control of wheat bunt [*Tilletia tritici* and *T. levis*] by the germisan short disinfection process, using the Puk apparatus [*R.A.M.*, vi, p. 404; vii, p. 153]. Other suitable machines are Lothrä, Primus B, Ideal, Globus, or the continuous apparatus supplied by Bartels Söhne. The average cost of treating 1 cwt. of wheat and rye by this process is only Pf. 24 and 16, respectively, compared with Pf. 30 to 168 for sprinkling, immersion, or dusting.

GRAM (E.). **Vintersaedens Afsvampning.** [Disinfection of winter seed-grain.]—*Ugeskr. for Landmaend*, lxxiii, 36, p. 569, 1928.

Some of the data on seed-grain disinfection obtained from the official monthly phytopathological survey for July are summarized. It appears that the treatment of wheat has now become a part of the general routine, whereas rye is too often neglected in this respect. Experiments at Lyngby have shown that it is unsafe to use less than 30 gm. of germisan or tillantin C in 12 l. of water per 100 kg. of seed-grain for sprinkling against wheat bunt [*Tilletia tritici* and *T. levis*]. The same applies to sanagran VII and VIII and tox-till, all of which gave good results at the rate of 30 gm. per 12 l., while danatin was very effective at 60 gm. per 12 l. Dusting the seed-grain with 50 or 60 gm. of germisan or tillantin C, followed by moistening with 2 or 3 l. of water, also gave excellent control. The incidence of flag smut of rye [*Urocystis occulta*] was reduced from 16 to under 1 per cent. by sprinkling with tox-till (30 gm. per 12 l.), and to between 1 and 2 per cent. by the same quantity of germisan, sanagran VII and VIII, and tillantin C [see also *R.A.M.*, vii, p. 153].

Feeding copper carbonate-treated Wheat to poultry.—*Agric. Gaz. New South Wales*, xxxix, 9, p. 660, 1928.

Tests conducted at Wagga Experimental Farm and at the Government Poultry Farm, Seven Hills, New South Wales, indicated that

copper carbonate-treated wheat had no ill effects when fed to poultry for two or three months.

SAMUEL (G.). **Two 'stunting' diseases of Wheat and Oats.**—*Journ. Dept. Agric. S. Australia*, xxxii, 1, pp. 40–43, 3 figs., 1928.

The occurrence of diseased patches in wheat and oat crops (in one instance affecting more than three-quarters of a crop of 84 acres) is becoming of serious economic importance in South Australia. Seedlings cease growth when a few weeks old, remain stunted and spindly, and have thin, stiff (or with wheat, sometimes weak and drooping), slightly rolled leaves, which, especially in oats, may become reddish or purple. Examination of the roots showed that these symptoms are produced either by eelworm attack or by a species of *Rhizoctonia*, the latter causing the roots to die back from the tips and turn brown, while shrunken patches may occur on the thicker roots. When isolated from diseased plants and inoculated into soil with germinating seedlings, the fungus produced root symptoms typical of field infection. Further investigations are in progress.

GORDON (W. L.) & BAILEY (D. L.). **Physiologic forms of Oat stem rust in Canada.**—*Scient. Agric.*, ix, 1, pp. 30–38, 3 figs., 3 maps, 1 chart, 1928.

This is an amplified account of recent work on the occurrence of physiological forms of oat stem rust (*Puccinia graminis avenae*) in Canada, a preliminary notice of which has already appeared [*R.A.M.*, vii, p. 574]. The forms 2 and 5 have predominated during each of the three years 1925 to 1927, constituting some 95 per cent. of all the collections. Against the new form 6 no variety has hitherto been found to show appreciable resistance. Form 4, previously only known from Sweden, was collected ten times and proved exceedingly virulent.

DIETZ (S. M.). **Inheritance of resistance in Oats to Puccinia graminis avenae.**—*Journ. Agric. Res.*, xxxvii, 1, pp. 1–23, 5 figs., 1928.

This is the full paper by the author on the inheritance of resistance in oats to *Puccinia graminis avenae*, an abstract of which has already been noticed [*R.A.M.*, iv, p. 409]. An additional point of interest is that in crosses between resistant varieties of oats, such as Green Russian × Richland and White Russian × Ruakura, the F_1 plants were resistant, while the F_2 segregated and produced some plants which were more resistant than either parent. It is, therefore, thought probable that other factors than the two considered in this paper are involved in the inheritance of resistance to the rust.

SAPPOK [H.]. **Ist der Flugbrand der Wintergerste wirklich harmlos?** [Is the loose smut of winter Barley really harmless?]—*Deutsche Landw. Presse*, lv, 36, p. 521, 1928.

The writer does not share the general indifference of German farmers to the attacks of loose smut of barley [*Ustilago nuda*],

which is stated to have caused extremely heavy losses in the northern parts of Silesia during the winter of 1927–8 (10 to 20 per cent. of the yield, representing several thousand hundred-weight of grain) [*R.A.M.*, vi, pp. 14, 25]. The hot-water method of control is applicable only in cereal breeding institutions and the like, being much too complicated for ordinary use The best, quickest, and cheapest way of securing healthy crops is by the use of certified original seed, which can be relied on to be free from smut. If grown at a distance of 300 to 500 m. from any infected crop the produce can be used to provide seed for the following year. A brief note is given on the practice of estimating the incidence of infection by the number of diseased ears per 100 paces, and in this connexion it is stated that the German Agricultural Society rejects all stands having more than 3 such ears per 100 paces.

HEWLETT (C. H.). **Hot-water treatment of seed Barley.**—*New Zealand Journ. of Agric.*, xxxvii, 3, pp. 185–186, 1928.

In 1927–8 further tests were made at Canterbury, New Zealand, of the hot water treatment of seed barley against covered smut [*Ustilago hordei*], the method mainly consisting in pre-soaking for five to six hours at 60° to 70° F., followed by a dip of five minutes at 127°. The resulting crops were completely free from infection, this confirming the results obtained in the two previous seasons [*R.A.M.*, vi, p. 661]. Over 400 acres of various varieties of the treated seed were sown, the machinery used being thoroughly disinfected with formalin to prevent re-infection of the product. Sufficient once-removed seed [i. e., obtained from a crop grown from treated seed] was thus obtained to sow all the Canterbury barley crops for the ensuing season.

MACKIE (W. W.). **Inheritance of resistance to rusty blotch in Barley.**—*Journ. Agric. Res.*, xxxvi, 11, pp. 965–975, 5 figs., 1928.

After a brief reference to the increasing economic importance of rusty blotch of barley (*Helminthosporium californicum*) [*R.A.M.*, iii, p. 331] in California, the author gives some details of experiments made at Davis and Berkeley on the inheritance of resistance to the disease in reciprocal crosses between Chevalier (*Hordeum distichon*), an immune variety, and Abyssinian (*H. deficiens*), a susceptible variety. The F_1 generation of the crosses was found to be completely free from attack, while in the F_2 segregation occurred in the ratio of three immune to one susceptible plant, thus indicating a single factor difference for resistance. This ratio was confirmed in the F_3 families. The F_1 generation produced plants like *H. deficiens*, which gave rise in the F_2 generation to plants homozygous for both *H. distichon* and *H. deficiens* and to intermediates, in a Mendelian ratio of 1 : 2 : 1; this ratio was also confirmed by the F_3 families. There was no decided evidence of linkage, and no infertility of the progeny ensued on crossing these two species of barley.

STANG. **Ungeklärte Schädlichkeit amerikanischer Gerste.** [Unexplained toxicity of American Barley.]—*Deutsche Landw. Presse*, lv, 39, p. 564, 1928.

Large quantities of barley imported from the United States and Canada have been fed to swine in the Bremen, Oldenburg, and Hamburg districts with very unsatisfactory effects on the health of the animals. Similar reports have also been received from Holland. Microscopic examination of the affected samples revealed the presence of *Gibberella saubinetii*. Extensive feeding experiments are stated to be in progress at the Berlin Veterinary College.

PAPE (H.). **Das Mutterkorn und seine Bekämpfung.** [Ergot and its control.]—*Illus. Landw. Zeit.*, xlvii, 37, pp. 474–475, 1928.

According to the official reports of the Biologische Reichsanstalt, ergot of rye (*Claviceps purpurea*) occurred in a very severe form in many parts of Germany during 1928. In Hanover the incidence of the disease during July was higher than at any time for the last thirty years, and in parts of Brandenburg 50 to 60 per cent. infection was recorded. Heavy damage was also reported from Oldenburg, Mecklenburg, Pomerania, Hesse-Nassau (where wheat was also badly infected in places), the Rhine Provinces, and elsewhere. Directions are given for the control of the disease by appropriate cultural measures.

REDDY (C. S.) & HOLBERT (J. R.). **Differences in resistance to bacterial wilt in inbred strains and crosses of Dent Corn.**—*Journ. Agric. Res.*, xxxvi, 10, pp. 905–910, 2 figs., 1928.

Bacterial wilt or Stewart's disease of maize (*Aplanobacter stewarti*) is stated to cause heavy and increasing losses among early maturing varieties, e. g., Golden Bantam, which are extensively grown for canning purposes. Notwithstanding thirty years of investigation, no means of control have yet been found [cf. *R.A.M.*, vi, p. 158], and a series of experiments [the results of which are tabulated and briefly discussed] was accordingly undertaken at Bloomington, Illinois, to determine the relative resistance to bacterial wilt of a number of inbred lines and crosses of yellow Dent maize.

It was found that all the progenies of certain inbred lines showed a uniformly high degree of resistance, suggesting the possibility of developing this character in some of the popular susceptible sweet varieties. In most cases the crosses were more resistant in the F_1 generation than their component inbred strains. Some of the inbred lines, however, were only moderately resistant, while others again were uniformly susceptible.

No apparent correlation was observed between resistance to bacterial wilt and vegetative vigour or resistance to other important maize diseases.

WESTON (W. H.) & WEBER (G. F.). **Downy mildew (Sclerospora graminicola) on Everglade Millet in Florida.**—*Journ. Agric. Res.*, xxxvi, 11, pp. 935–963, 2 pl., 3 figs., 1 map, 1928.

Since the first record in 1922 of the downy mildew of Everglade

millet (*Chaetochloa* [*Setaria*] *magna*) caused by *Sclerospora graminicola* in Florida [*R.A.M.*, v, p. 419]. the fungus has been found to occur on this host in 14 counties of that State, where its distribution appears closely to follow that of the grass. This suggests the possibility of its also existing in other localities of the Gulf States, Central America, and the West Indies, within the natural range of the grass. Another inference is that, contrary to the opinion prevailing hitherto, the fungus is probably native to the south-eastern part of the United States. A careful search in Florida for over four years failed to reveal it on any other host but the Everglade millet.

A detailed study during five years of the morphology and biology of *S. graminicola* [a description of which is given at length] showed that under Florida's subtropical conditions the organism runs through the same conidial [ibid., iii, p. 718] and oospore stages on the Everglade millet as described on other hosts and in other countries within its wide range of distribution. Its attack usually results in a conspicuous systemic infection, from which the grass does not recover, new shoots being invaded successively as they sprout. In addition, there also occurs a local type of infection, limited to restricted spots on the leaves; plants thus affected are likely to escape notice in the field, since they do not show striking symptoms, such as pallid markings of the leaves, stunted growth, and malformations of the inflorescences. This type of infection is relatively frequent, many fields of the grass showing hardly a single apparently healthy plant that, on close examination, did not have at least a few scattered spots of local infection on its leaves. The morphological details of the conidia (zoosporangia) and oospores, as determined from [tabulated] measurements of 250 conidia and of 1,000 oospores, also entirely agree with those described from other hosts.

In a discussion of the part played by the conidial and oospore stages of the disease in its local and long-distance spread, and in its persistence from year to year, stress is laid on the importance of the oospores, since infection of Everglade millet seedlings was obtained in experiments in which the soil contained oospores that had been kept resting for over nine months. So far, the disease is of no economic importance in Florida, but should a susceptible crop be introduced, its wide distribution in that State and the nature of the parasite might render it very troublesome and difficult to control.

BACH (W. J.) & WOLF (F. A.). **The isolation of the fungus that causes Citrus melanose and the pathological anatomy of the host.**—*Journ. Agric., Res.*, xxxvii, 4, pp. 243–252, 1 fig., 1928.

For the first time, the writers have succeeded in isolating the causal organism of citrus melanose (*Diaporthe citri*) from lesions on young orange and grapefruit leaves inoculated eight days previously with the conidial stage of the fungus (*Phomopsis citri*) [*R.A.M.*, vi p. 549]. Also, of 506 plantings of naturally produced melanose lesions from the above-mentioned hosts, as well as *Chaetospermum glutinosum*, Mexican lime, and faustrime (Mexican lime

×Australian finger lime), 115 yielded cultures of *D. citri*. Successful results were secured mostly from young lesions, since older ones are liable to contamination by secondary organisms, e.g., *Colletotrichum gloeosporioides* and *Diplodia natalensis*.

Infection takes place 36 to 48 hours after inoculation by direct penetration of the upper epidermis. The germ-tube passes downwards between the epidermal cells, whence it extends intercellularly between those of the palisade parenchyma. The first external symptoms appear after four days. At this stage the epidermal cells and intercellular spaces are occupied by a gummy substance, giving a bright red precipitate when treated with hydrochloric acid and phloroglucin, and thought to be a hemicellulose derivative resulting from the digestion of the cell wall by pectic enzymes, the presence of which was demonstrated. Four to five days after inoculation the primary cell membranes are involved in the gummous degeneration. Thin-walled cells can be observed at this stage floating free in the gum mass. The degeneration of the inner lamellae of the walls of these cells proceeds centripetally until the cell contents are set free by the complete disappearance of the wall. The dissolution and collapse of these cells causes a depression over the lesion. After about seven days the differentiation of a phellogen begins several layers below the area of gummosis and extends to the surface outside the lesion. The epidermal cells and any of the subepidermal tissues may take part in the formation of the suberized layer. A saucer-shaped suberized tissue, completely separating the invaded from the normal tissues, is thus formed. The growth of this proceeds until it is 7 to 12 cell-layers in thickness. Meanwhile the normal growth of the healthy tissues below the lesions causes the eversion of the corky layer with the consequent protrusion of the lesion above the surface. At this stage the affected parts are rough to the touch like sandpaper.

Cock (S. A.). **Rind marking of Citrus fruits. Finding the cause. Experiments in the year 1925–26.**—*Journ. Dept. Agric. Victoria*, xxvi, 9, pp. 549–556, 3 figs., 1928.

The rind blemishes of Victorian citrus fruits, known as 'scurf' and 'silver rust', have been found not to be due to insects or fungi but to wind and rain storms. No improvement in the condition of the affected fruit was achieved by spraying with various standard insecticides and fungicides.

Van Hall (C. J. J.). **Dutch East Indies: a new Coffee disease.**—*Internat. Rev. of Agric.*, N.S., xix, 9, p. 829, 1928.

The 'top die-back' of coffee, which has already caused heavy damage in the south of Sumatra [see above, p 91], was reported in February, 1928, from a mountain estate in east Java. The first symptom of the disease is the unequal growth of the upper branches on the different sides of the tree. On one side the young branches at the top attain their normal development, while on the other they remain more or less stunted. Thus the upper part of the stem assumes an asymmetrical appearance. The leaves of the poorly developed branches are first shed, followed gradually by those of the other young branches at the top of the tree. Eventually the

whole crown is defoliated and dies off. In young coffee plantations this disease may be responsible for very heavy losses.

BROWN (J. G.). **The influence of alkali in soils on the prevalence of angular leaf-spot in Pima-Egyptian Cotton.**—*Abstracts of Theses, Univ. of Chicago, Sci. Ser.*, iv (*1925–1926*), pp. 259–261, 1928.

There is stated to be a prevalent opinion that angular leaf spot of Pima-Egyptian cotton (*Phytomonas malvaceara*) [*Bacterium malvacearum*: *R.A.M.*, vii, pp. 443, 510] is less severe on alkali soils in Arizona than on those containing no alkali [ibid., v, p. 82]. In order to test the validity of this assumption, a comparative study was made of the incidence of the disease in cotton plants grown in both types of soil under greenhouse conditions at Chicago University, and in the field, garden, and laboratory in Arizona.

The results of the investigations showed that sodium chloride, in concentrations sufficiently low to permit the growth of cotton, decreases the amount of infection by *Bact. malvacearum* in the Pima variety. Sodium carbonate applied under similar conditions, failed to produce a like effect. No evidence was obtained that sodium chloride affects the resistance of the plants by influencing infection through the stomata, reducing the degree of succulence of the host, or modifying the acidity of the cell sap. The increased osmotic concentration found by other investigators in Pima cotton on alkali soils may be a factor in the promotion of resistance to angular leaf spot under such conditions.

Sodium chloride added to a 9 : 1 loam-sand mixture in a concentration of 0·4 per cent. of the air-dry weight of the soil seriously retarded germination and decreased the viability of the seed. Sodium carbonate (0·2 to 0·3 per cent.) exercised no injurious effect on germination.

Injuries to the cotyledons sustained in the process of shedding seed-coats and through the adherence of soil and portions of the tegmen were found materially to increase the amount of infection.

Concentrated sulphuric acid was found to be the best agent for the surface sterilization of seed, and a machine was devised for its application.

YOUNG (V. H.). **Cotton wilt studies. 1. Relation of soil temperature to the development of Cotton wilt.**—*Arkansas Agric. Exper. Stat. Bull.* 226, 50 pp., 5 figs., 5 graphs, 1928.

After a brief outline of the cotton wilt (*Fusarium vasinfectum*) problem and a survey of the literature on the disease from 1892 onwards, the author records his own observations and experiments on its development at different soil temperatures in loamy fine sand from Fayetteville, Arkansas [*R.A.M.*, vii, p. 227].

Under controlled soil conditions, using Wisconsin soil temperature tanks, and mixing the inoculum thoroughly with the soil before sowing, the very susceptible Trice cotton is most severely affected by wilt at temperatures near 30·5° C., though a range from 28° to 32° is favourable to the development of infection [ibid., vii, p. 320]. There is a rapid decline in the severity of the

disease above 33° and also more gradually below 28°, a slight incidence having been registered as low as 18°. Serious infection is not likely to occur in the field at soil temperatures below 23° except in particularly susceptible varieties. The temperature relations for the growth of *F. vasinfectum* were found to be closely correlated with those for the development of wilt.

Soil temperatures were found to have a very marked effect on the incubation period of the wilt, which appeared in less than 12 days from the time of sowing at 28° to 35·5° and caused the heaviest damage within the first 24 days. Below 28° the incubation period became progressively longer, so that at 20·5° only 5 per cent. of infection was present at the end of 24 days, while at 18° only a trace was observed before the 36th day.

Air temperatures as low as 24° may arrest the rate of development of *F. vasinfectum* in the stems of the cotton plant even when soil temperatures favour its growth in the roots. Under these conditions the whole vascular system of the roots may be noticeably affected and discoloured without internal darkening of the stems or apparent injury to the aerial parts.

The thorough admixture with the soil of comparatively large amounts of the cotton wilt fungus in pure culture results in a greatly increased incidence of infection as compared with the addition of inoculum only to the upper two or three inches of soil, in which case the rapid growth of young cotton roots through a shallow inoculated zone apparently enables the plants frequently to escape attack.

Records of air temperatures taken at two localities in Arkansas in 1926 and 1927 strongly indicate that the virtual absence of wilt, even in susceptible varieties, for over a month after planting is due to the inhibitory effects of low soil and air temperatures rather than to any lack of susceptibility in the seedlings. Probably the soil temperatures in Arkansas are most favourable to the development of wilt in July and August, the period when the disease is most prevalent.

A study of environmental factors in connexion with the occurrence of cotton wilt points to a close relationship between the conditions promoting the rapid saprophytic development of the fungus in the soil and the spread of the disease. It is suggested that, under normal conditions, warm, well-aerated, sandy soils with sufficient organic matter for the development of the pathogen, may permit the rapid dissemination of the latter through the soil and thus facilitate attacks on the roots.

Since the soil temperatures of the spring months in Arkansas are unfavourable to the development of wilt, it is obvious that varieties which germinate and grow better in cool soil, e. g., Cook, Dixie Triumph, and Super Seven, will stand a better chance of escaping infection than the late-maturing and non-cold-resistant varieties, such as Trice and Webber.

Castellani (A.). **Blastomycosis and some other conditions due to yeast-like fungi (budding fungi).**—*Amer. Journ. Trop. Med.*, viii, 5, pp. 379–422, 19 figs., 1 diag., 1928.

Full morphological and physiological particulars are given of a

number of fungi implicated in the etiology of blastomycosis and allied conditions, with clinical reports of illustrative cases investigated by the author.

As, for botanical reasons, the name *Blastomyces* applied to one of the genera of yeast-like human pathogens cannot stand, the substitution of the name *Blastomycoides* is now definitely proposed to include the species *B. dermatitidis*, *B. immitis*, and *B. tulanensis* [*R.A.M.*, vii, p. 513]. These are characterized by an abundant mycelium in artificial culture but have only large, roundish budding cells with a double-contoured wall in the affected tissues. The asci described by some authors are believed to be only conidia containing granules. A number of illustrative cases of human diseases caused by fungi of this type are described in detail.

Several species of *Cryptococcus* believed to be pathogenic to men and animals are described. The genus resembles *Saccharomyces* but no ascigerous form is known. The budding cells are smaller than in *Blastomycoides* and without a thick wall.

In the genus *Saccharomyces* smooth, round ascospores are formed in single (non-conjugating) cells. The mycelium, when present, remains rudimentary, and the budding cells are thin-walled. Several species have been found associated with diseases of various types in man.

The genus *Debaryomyces* comprises Saccharomycetaceae with asci containing verrucose ascospores. Only one pathogenic species, *D. hudeloi*, appears to be known.

A discussion of the genus *Monilia* [as understood in medical literature and, in part at least, corresponding to Berkhout's genus *Candida*: ibid., iii, p. 556] is given. The species form hyphae in the lesions but mostly yeast-cells in culture. Ascospores are not known. A key is given to the species, classified by biochemical characters which are stated to be permanent in certain species, but are inconstant in others. The present tendency, according to the author, is to extend the term *Monilia* to cover all those organisms of the Oosporaceae of which the thallus, in its parasitic life (i. e., *in situ* in the lesions), appears composed of mycelial hyphae as well as free budding forms.

Blastomycosis proper is usually taken to cover only such cases of infection by yeast-like fungi as produce deep-seated lesions. The fungi concerned are mostly species of *Blastomycoides* but some are associated with *Cryptococcus*.

SHAW (F. W.). **The classification of the genus Monilia.**—*Amer. Naturalist*, lxii, 682, pp. 478–479, 1928.

Great confusion is stated to prevail as regards the classification of the genus *Monilia* as recognized in medical literature [see preceding abstract]. The author believes that the microscopical structure of these fungi is constant in the different species, and that it may be used as a basis for a morphological classification of the genus. A preliminary summary of the distinguishing characters of six species, differing in the size of the mycelial segments, the shape of the moniliform clusters, and the dimensions, shape, and arrangement of the cells composing the clusters, is given. The species studied were *M. psilosis* [ibid., vii, p. 512], *M.* [*Candida*]

albicans, M. zeylanoides, M. krusei, and *M. richmondi* [ibid., vii, p. 168].

MARTINS (C.). **Mycose pulmonaire à Rhizomucor parasiticus.** [Pulmonary mycosis due to *Rhizomucor parasiticus.*]—*Comptes rendus Soc. de Biol.*, xcix, 26, pp. 957–958, 1928.

The cultural and morphological characters of *Rhizomucor* [*Rhizopus*] *parasiticus*, isolated from the sputum of a female patient suffering from lung trouble, are briefly described. The fungus developed on all the usual media at room temperature and up to 37° C., with an optimum between 20° and 25°, giving rise to spherical sporangia of variable dimensions, containing oval, elliptical, reniform, and even horse-shoe shaped spores. Inoculation experiments on a rabbit and a guinea-pig gave positive results, while a dog failed to react to intervenal inoculation.

SABOURAUD (R.). **Généralités concernant les dermatophytes. (1er Mémoire).** [Generalities concerning the dermatophytes. (1st Memoir).]—*Ann. de Dermatol.*, Sér. VI, ix, pp. 656–669, 1928.

This is a general survey of the clinical and etiological aspects of various types of favus associated with species of *Achorion* and *Trichophyton*, the taxonomy and systematic position of which are briefly discussed.

FISCHER (W.). **Favus beim Kanarienvogel (Achorion passerinum).** [Favus in a canary (*Achorion passerinum*).]—*Dermatol. Wochenschr.*, lxxxvii, 39a, pp. 1359–1361, 2 figs., 1928.

A case of herpes of the arm in a patient of the author's was found to have been contracted through contact with a 13-year-old canary suffering from favus. Pure cultures of the organism responsible for the condition were obtained, with considerable difficulty at first, on fragments of the quill ends of feathers, and eventually on solid media. The pure white, septate mycelium with terminal branches and intercalary chlamydospores is reminiscent of *Achorion schoenleini*, while the general macroscopic and cultural characters of the fungus closely resemble those of *A. gallinarum* [*A. gallinae*] [cf. *R.A.M.*, vi, pp. 484, 485]. The latter organism, however, is characterized by the pronounced pink coloration of the cultures which is absent in the author's fungus, for which the name *A. passerinum* is accordingly proposed. Inoculation experiments gave negative results on white mice, but produced slight and readily curable herpetic lesions on human subjects.

HOFFMANN (H.). **Über eine Pilzerkrankung beim Affen, hervorgerufen wahrscheinlich durch Achorion gypseum.** [On a fungous disease of monkeys, probably caused by *Achorion gypseum.*]—*Dermatol. Wochenschr.*, lxxxvi, 11, pp. 353-354, 1928.

A monkey (*Macacus cynomolgus*) inoculated with pus from an inguinal lympho-granuloma developed symptoms somewhat resembling those of pityriasis rosea in human subjects. *Achorion gypseum* [*R.A.M.*, vii, p. 634] was isolated from the affected areas

and inoculated into guinea-pigs, monkeys (*M. cynomolgus* and *M. rhesus*), and a human subject with positive results.

Golay (J.). **Deux cas de trichophytie faviforme généralisée.** [Two cases of generalized faviform trichophytosis.]—*Ann. de Dermatol.*, Sér. VI, ix, 6, pp. 508–514, 4 figs., 1928.

Clinical details are given of two cases of generalized faviform trichophytosis in brothers aged 13 and 7, respectively. The causal organism was identified by Sabouraud as *Trichophyton discoides*, of which only two previous cases are believed to be on record.

Catanei (A.). **À propos de la culture des champignons des teignes en dehors des milieux usuels.** [Concerning the culture of ringworm fungi outside the usual media.]—*Comptes rendus Soc. de Biol.*, xcix, 26, pp. 736–737, 1928.

Referring to the experiments of Brocq-Rousseu and his collaborators in the culture of *Trichophyton gypseum* [*R.A.M.*, vii, pp. 719, 720], the writer states that he placed some hairs of a guinea-pig infected by *T. radiolatum* on sterilized fragments of straw, &c., in tubes containing a small amount of water. The fungus developed on these media at room temperature and proved pathogenic to the guinea-pigs into which it was inoculated.

Nanta (A.) & Chatellier. **Aspergillose cutanée et splénomycose.** [Cutaneous aspergillosis and splenomycosis.]—*Bull. Soc. Franç. de Dermatol., 1928*, 7, pp. 621–623, 1928.

A series of experiments is briefly described in which rabbits and guinea-pigs, inoculated with cultures of *Aspergillus nantae* after intravenous injections of saccharate of iron, developed the typical symptoms of splenomegaly [*R.A.M.*, vii, p. 782].

Toumanoff (K.). **Au sujet de l'aspergillomycose des abeilles.** [On the subject of aspergillomycosis of bees.]—*Comptes rendus Acad. des Sciences*, clxxxvii, 7, pp. 391–393, 1928.

Full details are given of the writer's experiments on the pathogenicity to bees of two strains of *Aspergillus flavus*, isolated from silkworms and bees, respectively. Positive results were given in both series of tests, the first comprising 15, and the second 20, healthy bees, which were fed on syrup with an admixture of spores of the fungus. A post-mortem examination showed that there was no general spread of the fungus through the insects' bodies, and a further experiment proved that the filtrate of cultures, administered as above, was equally toxic with the spores. It is believed that, in certain cases, the bees are killed by the elaboration, under the influence of the gastric juices, of the toxic products of *A. flavus*.

Kletschetoff (A. N.). Главнейшие болезни Льна. [Chief diseases of Flax.]—Pamphlet of *Всеросс. Центр. Коон. Союз Льноводов и Коноплеводов „Льноцентр“.* [*All-Russian Centr. Co-op. Union Flax- and Hemp-Growers 'Flaxcentre'*], Moscow, 16 pp., 16 figs., 1928.

In this paper brief, popular descriptions are given of the prin-

cipal fungous diseases prevalent on flax in Central Russia, the majority of which have already been dealt with by the author in two previous papers [*R.A.M.*, vi, p. 420]. Additional records are those of stem diseases caused by *Ascochyta linicola* [ibid., v, p. 611] and *Phoma linicola* [ibid., vi, p. 258], and of swellings which appear on the stems and greatly impair the quality of the fibre by causing it to break into short lengths; the cause of the latter trouble has not yet been established. Recommendations are made for the control of all the diseases, particular stress being laid on the necessity of disinfecting the seed before sowing, as by far the greater part of the flax seed used in Russia has been repeatedly shown to be heavily contaminated with various organisms.

NICOLAS (G.) & AGGÉRY (Mlle). **Observations sur deux champignons de l'Agave americana L.** [Notes on two fungi occurring on *Agave americana* L.]—*Bull. Soc. Myc. de France*, xliv, 2, pp. 215–216, 1928.

The examination of a number of sickly plants of *Agave americana* in a locality of the Pyrénées-Orientales showed the occurrence, on desiccated spots on the leaves, of two types of fungal fructifications. The first to appear (before the final desiccation of the tissues under the spots) were aggregations of spherical or somewhat applanate, brownish-black, sub-epidermal pycnidia, measuring 200 to 250 by 200 to 210 μ in diameter. On maturing, the pycnidia break through the cuticle and liberate very numerous unicellular, hyaline (later brownish), ovoid or subspherical spores, measuring 4 to 7 by 4·6 to 5·5 μ, and borne on light brown sterigmata. This organism is considered to be a true parasite, and is identified as *Coniothyrium concentricum* (Desm.) var. *agaves* Sacc., a fungus which appears to differ from *C. concentricum* (Desm.) Sacc. in the mode of opening of the pycnidia and in the size of its spores. As far as the authors are aware, this is the first record of this fungus in France.

The second type of fructification occurring on the leaves was identified as *Stagonospora macrospora*, a saprophyte which has already been recorded on this host in the same neighbourhood.

ABT [G.]. **L'épilage par les diastases de la moisissure Aspergillus oryzae.** [Depilation by the diastases of the mould *Aspergillus oryzae*.]—*Cuir Tech.*, xvii, 18, pp. 406–407, 1928.

Full technical details are given of the process of skin depilation by means of the diastases of *Aspergillus oryzae* [*R.A.M.*, vii, p. 385], a preparation of which is now sold under the name of 'sojal' by the Compagnie Industrielle des Diastases, 11 Rue de la Pépinière, Paris.

WRIGHT (J.). **The causal parasite of the Lily disease.**—*Trans. & Proc. Bot. Soc. of Edinburgh*, xxx, 1, pp. 59–65, 2 figs., 1928.

Since the publication of Marshall Ward's well-known paper (*Ann. of Botany*, ii, p. 184, 1889) on the lily disease caused by a species of *Botrytis*, no further reference seems to have been made

to this subject in phytopathological literature. Recent outbreaks of a similar disease among lilies (*Lilium candidum*) near Edinburgh and Bristol, respectively, have been found to be due to a fungus corresponding in detail with that described by Ward [cf. also *R.A.M.*, viii, p. 41].

Orange-brown specks appear on the leaves, stems, pedicels, or buds, which subsequently turn brown and shrivel. The septate, profusely branched mycelium exudes translucent droplets containing a cellulose-dissolving ferment. Complex tassel-shaped appressoria are formed, but not so early or abundantly as in *B. cinerea*. The septate, dark brown conidiophores with hyaline apices measure 12 to 16 μ in diameter and are of variable length. They arise directly from the mycelium as thick, blunt, erect hyphae. Under humid conditions as many as ten heads of conidia attached by short sterigmata may be produced by one conidiophore. The conidia, which measure 18 to 32 by 13 to 24 μ (average 25 to 26 by 18 μ), are globose and hyaline at first, becoming ovoid and assuming a sepia tint later. On Quaker oats and potato media the conidia are abnormally shaped and may be twice the usual size. The number of germ-tubes in hanging drops at room temperature ranges from one to eight from each conidium. The white (later black) sclerotia are partially embedded in the tissues and are often roundish (average 1 mm. in diameter), but elliptical and irregular forms, 1 to 6 by 0·5 to 1 mm., are common. They form conidia on germination, but no microconidia were observed.

The fungus is undoubtedly a *Botrytis* as stated by Ward, though it was referred to *Ovularia* as *O. elliptica* by Berkeley and later called *Peronospora elliptica* by W. G. Smith. Its differences from other species of *Botrytis* are summarized by the author, who names it *B. elliptica* (Berk.) Wright, and furnishes a detailed diagnosis in English. [The author has apparently overlooked the fact that this alteration has already been made: cf. Cooke, M. C., 'Fungoid pests of cultivated plants', p. 64, 1906.]

The severity of the disease may be minimized by the choice of sheltered southern exposures for the beds, and by the burning of infected material.

NICOLAS (G.) & AGGÉRY (Mlle). **Note sur deux Phyllosticta parasites de plantes ornementales.** [Note on two species of *Phyllosticta* parasitizing ornamental plants.]—*Bull. Soc. Myc. de France*, xliv, 2, pp. 210–214, 2 figs., 1928.

Brief descriptions and Latin diagnoses are given of two new species of *Phyllosticta* which were observed in the Botanical Garden in Toulouse, namely: *P. daphniphylli* causing the defoliation of *Daphniphyllum glaucescens*, and *P. fici-elastici* forming amphigenous, circular spots on the leaves of *Ficus elastica*. Both diseases are believed to be easily controllable by the removal and destruction of the leaves as soon as the first symptoms of infection appear.

FÜRST (L.). **Schäden durch Uspulun?** [Injury from uspulun?] —*Gartenwelt*, xxxii, 37, pp. 506–507, 1928.

Uspulun is stated to be now very generally used in Germany as

a seed and seed-bed disinfectant against the propagation fungus [*Moniliopsis aderholdi*: *R.A.M.*, vii, p. 516]. The writer describes an experiment in which his dahlia seedlings, transplanted into a seed-bed previously disinfected with a solution of 50 gm. of uspulun in 10 l. of water per sq. m., developed a rolling and discoloration of the leaves and failed to root. Delphinium seedlings grown in beds treated with weaker solutions of uspulun also failed to develop but recovered on transference to fresh soil.

PAPE (H.). **Der Rittersspornmeltau und seine Bekämpfung.** [Larkspur mildew and its control.]—*Gartenwelt*, xxxii, 36, pp. 496–497, 1 fig., 1928.

Larkspurs [*Delphinium*] in Germany are stated to be very subject to mildew [*Erysiphe polygoni*] [*R.A.M.*, vi, p. 511]. The disease appears to be most prevalent on poor, light soils, and in enclosed situations where ventilation is deficient. In the summer of 1928 the varieties Schwalbach and Mvr. de Kat were heavily infected in the neighbourhood of Berlin, while Andenken an Koenemann was immune. Larkspur mildew may be controlled by suitable cultural measures, supplemented by sulphuring or the application of a liquid fungicide.

ENGEL (E.). **Hortensien-Mehltau auch in Amerika.** [Hydrangea mildew also in America.]—*Gartenwelt*, xxxii, 23, p. 314, 1928.

In the spring of 1927 some hydrangea plants imported by the writer from Germany developed symptoms of mildew [*Oidium hortensiae*: *R.A.M.*, vii, p. 447] at Columbus, Ohio. The disease was particularly severe on the Elmer, Lancelot, Marshal Foch, Cayeux, and Coquelicot varieties. Satisfactory control was obtained by means of fumigation with sulphur.

DE BRUYN (HELENA L. G.). **Is ontbladering als bestrijdingswijze tegen Phytophthoraziekte van de Seringen gewenscht?** [Is the removal of the leaves desirable as a control measure for the *Phytophthora* disease of Lilacs?]—*Tijdschr. over Plantenziekten*, xxxiv, 9, pp. 233–238, 2 pl., 1928. [English summary.]

In a previous paper on the etiology of the lilac epidemic caused by *Phytophthora* [*syringae*] in Holland [*R.A.M.*, iv, p. 36], the author recommended picking the leaves by hand in September or October as a means of preventing infection. Experiments have shown, however, that this process adversely affects the development of the plants by delaying the opening of the buds and reducing the size of the inflorescences. In most cases the loss from this source is likely to exceed that due to the attacks of the fungus, and the measure should therefore be discontinued.

BARRUS (M. F.) & HORSFALL (J. G.). **Preliminary note on Snowberry anthracnose.**—*Phytopath.*, xviii, 9, pp. 797–801, 2 pl., 1928.

The common snowberry (*Symphoricarpos albus* var. *laevigatus*), which is stated to be widely grown for ornamental purposes, is

severely affected by an anthracnose in the vicinity of Ithaca, New York. Reports of the disease have also been received from other parts of New York, Arkansas, Iowa, and Wisconsin.

Early in the spring small, circular, dark purple to black spots, subsequently developing pale to dirty grey centres, appear on the leaves, and later may coalesce into large, irregular areas. Similar but less conspicuous lesions develop on the flower- and leaf-buds before they unfold, while the berries are marked by purple to black or pink, depressed spots which may cause deformity and lead eventually to a shrivelling and mummification.

A species of *Sphaceloma* was isolated a number of times from diseased leaves, twigs, and berries and successfully reproduced the symptoms of the disease. This fungus, which is named *S. symphoricarpi* n. sp. (with a diagnosis in English), is characterized by subcuticular or subepidermal, solitary, gregarious, or confluent, irregular acervuli, 50 to 300 μ in diameter; and dark, simple, sharp-pointed conidiophores bearing oblong-ellipsoid, hyaline to slightly dark conidia, measuring 6 to 9 by 3 to 5·4 μ. The organism resembles rather closely *S. ampelinum* [usually known as *Gloeosporium ampelophagum*] but differs in cultural characters, which are described. There is said to be some evidence that control may be effected by timely applications of copper-lime dust.

SUNDARARAMAN (S.) & RAMAKRISHNAN (T. S.). **A leaf-spot disease of Safflower (Carthamus tinctorius) caused by Cercospora carthami, nov. sp.**—*Agric. Journ. of India*, xxiii, 5, pp. 383–389, 5 pl. (2 col.), 1928.

In 1921 a leaf spot of safflower (*Carthamus tinctorius*) occurred in an epidemic form at the Central Farm, Coimbatore (Madras), during a period of high atmospheric humidity (80 per cent. at the beginning of the outbreak). The disease, which was found to be due to a species of *Cercospora*, was again recorded in 1922, 1924, and 1925.

Infection may take place at various stages during the growth of the plant, from about a month after sowing to just before flowering. Small, round or irregular, slightly sunken, brown spots (sometimes yellow-bordered) appear on the lower leaves and subsequently spread over the rest of the plant. Severely infected leaves become brown and misshapen, and eventually the tissues disintegrate, the holes between the veins imparting a worm-eaten appearance to the foliage. The fructifications of the fungus are present as minute black dots on both leaf surfaces and on other affected organs. Lesions also develop on the bracts and in severe cases the entire capitulum and part of the stem may be involved.

This safflower parasite does not appear to have been previously described and is accordingly named *C. carthami* n. sp. [a technical diagnosis of which is given in English]. Its mycelium is hyaline, later smoky-brown, and both inter- and intracellular. The conidiophores are brown, almost invariably simple, sometimes geniculate at the apex, and measure on an average 150·8 by 4·6 μ. The conidia are hyaline, linear, tapering, sometimes slightly curved, measuring 33·6 to 260 by 3·2 to 6·3 μ, and having 2 to 23 septa.

The cultural characters of the fungus on a number of standard

media are described: the best development occurred under slightly acid conditions (between +5 and +15 Fuller's scale). The pathogenicity of the organism was demonstrated by a series of inoculation experiments on safflower plants. Negative results were given, however, by similar tests on 13 other plants known as hosts of various species of *Cercospora* in the vicinity.

Seed treatment was found to be practically useless, but good protection was afforded by spraying with 1 per cent. Bordeaux mixture before the onset of the disease.

ALCOCK (Mrs. N. L.) & MARTIN (M. S.). **A seed-borne disease of Clover (Trifolium repens L.).**—*Trans. & Proc. Bot. Soc. of Edinburgh*, xxx, 1, pp. 13–18, 1 pl., 1928.

This is a more detailed account of the discovery of *Sclerotinia trifoliorum* in the seed of *Trifolium repens* imported into Scotland from Central Europe and New Zealand than that already noticed [*R.A.M.*, vii, p. 642]. In the size of its asci and ascospores (186 and 16·8 μ long, respectively), and general life-history, the fungus agrees with *S. trifoliorum*, but the apothecial disks are considerably smaller (0·5 to 3 compared with 1 to 10 mm.), and it is thought that the seed-borne organism may be a dwarf variety of the species. So far, inoculation experiments with the newly isolated fungus have only given positive results on one plant of English wild white clover from Cambridge.

JONES (F. R.). **Winter injury of Alfalfa.**—*Journ. Agric. Res.*, xxxvii, 4, pp. 189–211, 2 pl., 11 figs., 1928.

A detailed description is given of the histological characters of the tissues of lucerne plants affected by winter injury in the central Mississippi Valley [*R.A.M.*, vii, p. 786]. The injury in the plant tissue has been found to originate in characteristic positions in the parenchyma of the phloem rays, in the central pith-like structure of the upper part of the tap root, and in the xylem. In the spring of 1927 the injury first assumed the appearance of a mechanical disorganization of tissues in plants taken from beneath ice sheets in Wisconsin fields. The progressive healing of these injuries was traced through the spring. Severe winter injury appears not only to shorten the life of the plants, but also to furnish a point of entry for the causal organism of bacterial wilt (*Aplanobacter insidiosum*).

HOWITT (J. E.). **Another season's experience with Apple scab.**—*Fifty-ninth Ann. Rept. Fruit Growers' Assoc. of Ontario, 1927 (Ann. Rept. Dept. of Agric. Ontario, 1927)*, pp. 42–48, 1928.

A study of the life-history of the apple scab fungus [*Venturia inaequalis*] under Ontario conditions [*R.A.M.*, vi, p. 35] has shown that the greatest risk of infection is during the time from the bursting of the fruit buds till about four weeks after the petals fall (May and June). In the control of the disease four applications of a spray mixture are nearly always required, and in exceptional seasons when wet weather prevails during August and September, five or six may be necessary. The following schedule is recommended. (1) Early leaf or pre-pink spray: Bordeaux mixture

3–6–40 or lime-sulphur 1 in 40 (but there is a risk of burning with the latter preparation in cold, damp weather). (2) Pink spray: lime-sulphur 1 in 40 plus 3 lb. of hydrated lime and $1\frac{1}{2}$ lb. of lead arsenate or 1 lb. of calcium arsenate per 40 galls. of spray mixture. (3) Calyx spray: as under (2), but omitting calcium arsenate. (4) Small apple spray (about 12 days after (3)): lime-sulphur 1 in 50. (5) August spray (to be applied before 15th if the weather turns wet): as under (4). Full directions are given for the application of the sprays, and in conclusion replies are given to a number of questions bearing on the subject of scab control.

GABOTTO (L.). **La bolla nera del Pero.** [Black blister of Pear trees.]—*Curiamo le Piante !*, vi, 4, pp. 66–67, 1 fig., 1928.

During cold, wet springs, pear leaf blister [*Taphrina bullata*: *R.A.M.*, iii, p. 724] may cause dangerous defoliation and arrest the development of the flowers; in such seasons the trees should be sprayed when the buds open with 2 per cent. neutral Bordeaux mixture, the treatment being repeated at least twice at weekly intervals.

VALLEAU (W. D.). **Peach yellows and Potatoes.**—*Plant Disease Reporter*, xii, 9, pp. 102–103, 1928.

Peach yellows [*R.A.M.*, vii, p. 792] and an apparently similar disease on plums have developed in three different places at the Lexington Experiment Station. In one place two plum trees are affected, in another peaches and plums have shown symptoms of the disease since 1925, and in the third eight three-year-old Elberta peaches developed severe yellows in the summer of 1928. Kentucky being outside the recognized peach yellows area, and the trees having been obtained from an ostensibly healthy nursery, infection from some local perennial was suspected. In each case where yellows developed, potatoes had been grown within a few feet of the affected trees, and it seems reasonable to suppose that infection passed directly from the potatoes to the peaches. The virus disease of potatoes most nearly allied to yellows in its general nature is leaf roll, and further investigations are planned to ascertain whether the causal agent of both manifestations is identical.

FERRARIS (T.). **Peach yellows, Peach rosette e l'arricciamento del Pesco in Piemonte.** [Peach yellows, Peach rosette, and Peach leaf crinkle in Piedmont.]—*Curiamo le Piante !*, vi, 6, pp. 101–114, 1 pl., 1 fig., 1 diag., 1928.

A detailed account is given of the symptoms of a disease of peach trees at Vezza d'Alba which had been present at intervals for 20 years, but attained alarming proportions in 1928, spreading from tree to tree in every direction.

This condition first becomes apparent in spring, when the leaves at the extremities of some of the top branches curl up at the edges on either side of the principal vein, turn yellow between the veins, and fall, the disease gradually spreading to the lower branches. A rosette of small, deformed leaves forms at the end of the defoliated branches (which are attacked a few at a time), but these

eventually fall, whereupon the branch withers from the tip to the base. Later, the branches and trunk produce adventitious shoots which become covered with formations resembling the witches' broom of cherries (*Exoascus* [*Taphrina*] *cerasi*). Trees attacked the previous year put out numerous shoots of this type in the spring but they all die back progressively from the apex of the tree downwards and finally the whole tree dies. Death may be delayed by timely pruning and fertilizing. Diseased trees in the earlier stages may produce fruits which assume a greenish-yellow colour and fall prematurely, or ripen prematurely and remain incompletely developed. Branches of the second or third year become covered with enlarged lenticels which give them a characteristic roughened appearance, but there is no splitting of the bark nor gummosis. In these branches the phloem and cambium are discoloured, while the xylem appears to be normal. The roots remain perfectly healthy. The author considers that the disease is identical with peach rosette [*R.A.M.*, vi, p. 400], but states that it is evidently highly infectious, infection appearing to take place in the upper part of the tree, and presents the characters of a bacterial disease very like the 'mal nero' of the vine [*Bacillus vitivorus*: ibid., i, p. 154].

The control measures suggested include the destruction of dead and badly diseased trees, the disinfection of pruning implements, spraying with a 3 per cent. solution of iron sulphate after late pruning and 1 per cent. of the same after early pruning, the insertion of finely powdered iron sulphate into holes made in the trunk or at the base of affected branches, and the correction of high soil alkalinity by suitable mineral fertilizers.

VALLEAU (W. D.). **Bacterium pruni problem in Kentucky.**—*Plant Disease Reporter*, xii, 9, pp. 100–102, 1928.

The writer's present views on the situation in regard to bacterial spot of peach (*Bacterium pruni*) in Kentucky [*R.A.M.*, vi, p. 425: vii, p. 432 *et passim*] may be summarized as follows. The defoliation following severe attacks of the disease is due primarily to nitrogen deficiency, and only in a secondary degree to *Bact. pruni*. Healthy, vigorous trees, receiving a constant and adequate supply of nitrogen, possess the capacity to excise the affected leaf areas, leaving the remaining tissue perfectly healthy. In the defoliation, commonly attributed to bacterial spot, there is no relation between the number of spots on the foliage and the time of leaf fall. Entirely unaffected leaves may be shed, while those riddled with spots on the same twig may remain on the tree and apparently function normally. It will be observed that the shedding of the leaves is confined to the lower branches—a well-known concomitant of nitrogen starvation. Even heavy infection with *Bact. pruni* is incapable of causing defoliation on trees receiving a sufficient supply of nitrogen. This may be effected by growing a leguminous crop in the orchard and ploughing under the stubble or allowing it to lie on the surface. Successful results in the control of the defoliation usually ascribed to *Bact. pruni* have already been obtained by this method in three Kentucky orchards. On the other hand, the expensive clean cultivation operations generally

practised in peach orchards result in a rapid depletion of soil fertility due to accelerated nitrification during the summer and to erosion.

As a fruit spot, *Bact. pruni* can probably be controlled commercially by securing that there is sufficient foliage to protect the fruit from the driving rain carrying the organism.

FERRARIS (T.). **Mal bianco del Pesco sui frutti.** [Mildew of Peach on the fruits.]—*Curiamo le Piante !*, vi, 7, pp. 121–122, 1928.

Young fruit of peaches in Liguria were attacked by mildew (*Sphaerotheca pannosa*) [the symptoms of which are described] and showed a cracking of the skin, with consequent drying-up of the exposed pulp, a symptom stated to be commonest on glabrous varieties. Control consists in frequent early-morning applications of sulphur dusts, while, as the fungus overwinters on the branches, the diseased parts must be removed in autumn or winter, and the tree disinfected in the dormant season with two applications of super-sulphur or 3 per cent. cupric sulphur [*R.A.M.*, i, pp. 66, 67].

VOGLINO (P.). **Funghi parassiti delle piante da frutta, studiati nel 1927.** [Parasitic fungi of fruit trees studied in 1927.]—*Ann. R. Accad. Agric., Torino*, lxx, pp. 53–58, 1927. [Abs. in *Riv. Pat. Veg.*, xviii, 7–8, p. 170, 1928.]

The leaves and fruit of cherries in the province of Como were attacked by *Phyllosticta cerasella*, a fungus described by Spegazzini as a saprophyte on cherry leaves in the Argentine and indicated by Allescher, under the name *P. pruni-avium*, as a parasite of the bird-cherry: the author considers that damage wrought by this fungus is sometimes wrongly attributed to *Clasterosporium carpophilum* or *P. prunicola*. In some localities near Lake Maggiore a withering of the young branches of almond trees followed an attack by *Fusicladium amygdali* [*R.A.M.*, i, p. 220], which is stated closely to resemble *F. pirinum* [*Venturia pirina*].

PETERSON (P. D.) & JOHNSON (H. W.). **Powdery mildew of Raspberry.**—*Phytopath.*, xviii, 9, pp. 787–796, 2 figs., 1928.

Since 1923, when powdery mildew of raspberry was first reported from Minnesota, the disease has steadily increased, assuming an epidemic form on the red Latham variety during the last three years. Local leaf infections have been observed on other varieties of red and black raspberry, blackberry, and dewberry [*Rubus* spp.], but on these hosts the symptoms are never severe. A similar, possibly identical, mildew has been reported on raspberries in various other parts of the United States.

Since the perithecia of raspberry mildew have not yet been found in the United States, its definite identification is impossible, but it is thought it may be *Sphaerotheca humuli* which has been recorded on several American species of *Rubus*. Under field conditions in Minnesota, the mildew is invariably parasitized by *Cicinnobolus cesatii*, which may account for the absence of the perithecial stage.

The disease causes the dwarfing of the leaves and stunting of terminal growth from tip infection. The fungus may occur on both leaf surfaces, the petiole, and the stem. When local infections are numerous the leaves present a mottled appearance similar to that of mosaic.

Recent studies by the writers have shown that the mildew overwinters within the dormant buds in the stunted cane tips. The apparent absence of perithecia and short period of conidial viability (5 to 21 days) indicate that this is the usual (and perhaps sole) method of hibernation in Minnesota.

Spraying with Bordeaux mixture or lime-sulphur and dusting with copper-lime (ten applications) failed to control the disease in 1926. On the other hand, the practice of 'clean digging' (whereby all the canes in a row are dug up each autumn, permitting the new row to come up the following spring from underground parts in the inter-row space), proved an effective method of eradicating the fungus. Three seasons' observations have further indicated that raspberry mildew is not a serious problem where either the 'narrow hedge' (a single row of plants) or 'restricted hill' (three to five canes) system is used.

STEVENS (N. E.) & BAIN (H. F.). **Storage rots of Cranberries in the 1927 crop.**—*Phytopath.*, xviii, 9, pp. 809–814, 2 charts, 1928.

During 1927 the writers continued their investigation of storage rots in Howes and McFarlin cranberries [*Vaccinium macrocarpon*] under similar commercial conditions to those in 1926 [*R.A.M.*, vii, p. 184].

Compared with the previous year, a higher percentage of spoilage developed in 1927 among Massachusetts, New Jersey, and Oregon berries, and a lower proportion in those from Wisconsin. This increase was mainly due to rotting by the fungi *Guignardia vaccinii* and *Glomerella rufomaculans vaccinii*, both of which are more active at relatively high temperatures (the temperature was up to 70° F. in October and 48° in December, 1927, compared with 65° and 40°, respectively, in 1926). The fact that the Massachusetts and New Jersey berries were found to be actually sounder, when picked, in 1927 than in 1926 suggests that the warmer season was the primary factor in the increased amount of decay.

DEMAREE (J. B.). **Morphology and taxonomy of the Pecan-scab fungus, Cladosporium effusum (Wint.) comb. nov.**—*Journ. Agric. Res.*, xxxvii, 3, pp. 181–187, 1 pl., 2 figs., 1928.

This is an amplified account of the author's investigation of the pecan (*Hicoria* [*Carya*] *pecan*) scab fungus, which is now definitely transferred from the genus *Fusicladium* to *Cladosporium* as *C. effusum* (Wint.) comb. nov. [*R.A.M.*, vi, p. 106].

The symptoms of the disease, which only attacks young or growing tissues, are briefly described. The incubation period is stated to vary from 4 to 10 days. The first conidiophores emerge through the cuticle, but as the epidermis and cuticle are destroyed by the anastomosing hyphae, the later ones are produced directly on the surfaces of the newly formed stromata [ibid., iv, p. 72].

The conidiophores are dark brown at the base, becoming paler towards the apex. They vary from 40 to 75 μ in length and may be straight or flexuose, simple or laterally branched. Infected material incubated in a moist chamber at 24° to 26·5° C. showed the constant formation of conidia in acropetalous chains of two to nine (average probably four or five). Usually the chains originate at the apices of the conidiophores, but they may develop laterally immediately below or between the septa. They are light brown, fusiform, clavate, ovate or almost cylindrical, uni- to biseptate on germination, and measure 10 to 28 by 4·5 to 10 μ (average 17 by 7 μ).

The results of a comparative study of the causal organisms of pecan and peach scab (*C. carpophilum*) showed that both fungi develop very slowly in culture, produce a black, stromatoid growth, have catenulate conidia that are similar in shape, colour, and germination, and overwinter as stromata or pseudoparenchymatous masses. The only essential cultural difference observed was the sparse conidial production of *C. effusum* as compared with the abundant development of these bodies in *C. carpophilum*.

An emended technical diagnosis of *C. effusum* is given in English.

NOBLE (R. J.). **Woodiness of Passion-fruit. Cause of the disease discovered.**—*Agric. Gaz. New South Wales*, xxxix, 9, pp. 681–683, 2 figs., 1928.

The 'woodiness' or 'bullet' disease of passion fruit [*Passiflora edulis*] has been a serious trouble in New South Wales for many years. Affected fruits are hard, woody, of a purplish-leaden colour, and generally are small and deformed. The rind is abnormally thick, and the outer layers are often cracked and scaly. Fruits of all ages may be affected and young fruits, when severely attacked, may fall prematurely. Diseased vines generally appear stunted and sickly, with abnormally small, yellowish or mottled, often puckered and twisted leaves, especially on the end shoots. Mature leaves may develop small, pale yellow spots, especially between the veins. The disease is commonest in winter, and may be confined to individual vines, or be prevalent throughout a plantation. Slightly diseased vines may produce normal fruits in summer, but are less productive than healthy vines. Even young seedlings may be affected.

It has been established that this disease belongs to the virus type, the active principle being present in the sap. The disease was readily transmitted experimentally by mechanical means, which are considered to be probably the commonest form of transmission in the field.

The control measures recommended comprise the planting of healthy seedlings, the prompt removal and destruction of infected vines and of weeds likely to harbour insects, and precautions against transmission by pruning and other implements.

MARTIN (H.). **The scientific principles of plant protection.**—xii + 316 pp., London, Arnold & Co., 1928.

The primary object of this book is to give a comprehensive survey

of the scientific principles underlying methods of plant protection and so to present to the mycologist and entomologist a view of the chemical and physical aspects, and to the chemist and physicist a means of approach to the biological side of the question. In a brief introductory chapter the importance and development of the subject are considered, and this is followed by chapters on resistance of plants to disease and the influence of external factors on the liability of plants to attack. The part of the book dealing with fungicides amounts to 63 pages in all. Spraying and dusting in general are touched upon, while some account is also given of spreaders and stickers and their action. Fungicides are divided into two chief groups, those containing sulphur and copper, respectively, and the history, chemistry, and toxic action of these are discussed in some detail. The disinfection of seed and the partial sterilization of soil are treated in separate chapters. Toxic action and chemical constitution are compared and biological methods of control, including the control of insects by fungi and bacteria, are also considered, while the elimination of infection centres and of carriers or vectors are reviewed in the concluding chapters. Full bibliographical references are conveniently given at the end of each section. In such a wide field the treatment has necessarily been somewhat severely concise, but the author strikes new ground and the volume should prove of great value to all interested in the subject.

WEBER (G. F.). **Thread blight. A fungous disease of plants caused by Corticium stevensii Burt.**—*Florida Agric. Exper. Stat. Bull.* 186, 20 pp., 8 figs., 1927. [Received December, 1928.]

Most of the information in this bulletin on the thread blight of plants caused by *Corticium stevensii* [*C. koleroga*] has already been reported from another source [*R.A.M.*, vii, p. 247]. Additional hosts of the fungus recorded in this paper include soapberry (*Sapindus utilis*), jujube (*Zizyphus mauritiana*), chinaberry (*Melia azedarach*), plum (*Prunus angustifolia*), morning glory (*Ipomoea triloba*), and mu-oil tree (*Aleurites montana*).

ARNAUDI (C.). **Nuove esperienze sulla vaccinazione delle piante.** [New experiments on the vaccination of plants.]—*Riv. Pat. Veg.*, xviii, 7–8, pp. 161–168, 1928.

Continuing his investigations upon acquired immunity in plants [*R.A.M.*, v, p. 683] the author made needle-prick inoculations on 21st August, 1927, with a culture of *Bacterium tumefaciens*, on geranium plants (*Pelargonium zonale*), five of which bore tumours produced by inoculation with the same organism on 16th May, 1926, while five others showed large tumours resulting from inoculation on 26th November, 1925. The new inoculations were made two or three cm. above the existing tumours. Nine healthy geraniums inoculated at the same time and one with a deep sterile wound served as controls.

On 12th October, of 8 inoculation wounds in the first lot (3 plants had received a double inoculation) 6 had healed; one branch of a plant which had shown an old tumour at the bifurcation of two branches (both of which were inoculated) was healed, and a small

tumour had been produced on the other branch; the second plant which was inoculated twice developed a small tumour on one wound only, while in the third both wounds healed. In the second lot, of 5 inoculation wounds 3 healed, and 2 produced small tumours. Of the 9 inoculated healthy plants 2 recovered, 4 developed small tumours, and 3 developed large ones; the plant with the sterile wound recovered.

On 16th July, 1927, pea seedlings were placed in three Petri dishes on a layer of sand treated, respectively, with a water extract of the crushed mycelium of *Blepharospora* [*Phytophthora*] *cambivora*, (1) unheated, (2) kept for 30 minutes at 60° C., and (3) kept for 2 minutes at 100°. Control plants were placed on sand moistened with water in a fourth dish. The seedlings in the first dish were killed by the extract. On 24th July the remaining three lots of plants were placed in earthen dishes in the laboratory and all were inoculated with *P. cambivora* on 2nd August. All the inoculation wounds had healed by 8th August, when reinoculations were made. On 16th August the controls were dead, the rest being still living but evidently unhealthy; while by 28th August all the treated plants were dead.

On 15th October, three further lots of pea seedlings were placed on sand treated, respectively, with etherized extracts of *P. cambivora* and *Aspergillus oryzae*, and with water only. On 22nd October, 15 of each treated lot and 15 controls were removed to sand to which Knop's nutritive solution was applied daily. Three days later, all these plants were inoculated with *P. cambivora*, and after two more days there was slight fungal growth on all the inoculation wounds, though the controls appeared to be suffering most; by 19th November all the controls and the plants treated with the *A. oryzae* extract were dead, this being followed 10 days or more later by the death of the remainder. This result is considered to indicate that the immunization was specific for *P. cambivora*, but transitory.

HOLMES (F. O.). **Cytological study of the intracellular body characteristic of Hippeastrum mosaic.**—*Bot. Gaz.*, lxxxvi, 1, pp. 50–58, 1 pl., 1928.

The results of a cytological study, using mainly protozoological methods and monochromatic blue light (wave length 448·1 $\mu\mu$) photography, of the vacuolated intracellular bodies characteristic of mosaic in *Hippeastrum equestre* and a closely related hybrid species are described [*R.A.M.*, v, pp. 523, 765].

The intracellular bodies react in the same way as the cytoplasm of a young cell to all types of fixing solutions. The only two distinctive structures suggestive of nuclear material in them are (1) intensely staining dots not markedly different from others found outside the body in the cytoplasm of the host cell; and (2) spheres containing deeply staining, peripheral, single or rarely double balls. These spheres were also found in the host cell cytoplasm of diseased plants, but not in that of healthy ones. With Giemsa's stain, which stains nuclear chromatin an intense blackish-red, the first type of structure above mentioned stained only light blue like cytoplasm

and the second pale to deep blue, so that it appears that they do not contain nuclear material.

Chondriosomes were found distributed in moderate numbers within the intracellular bodies just as in the host-cell cytoplasm near by. This observation is considered to support the view that the intracellular body in this particular disease consists of living cytoplasm. Further research is necessary to determine whether the body represents a stage in a foreign organism or a mass of plant cell cytoplasm containing virus or stimulated by the diseased condition.

KERLING (L. C. P.). **De anatomische bouw van bladvlekken.** [The anatomical structure of leaf spots.]—*Meded. Landbouwhoogeschool te Wageningen*, xxxii, 6, 107 pp., 26 figs., 1928. [German summary.]

Most leaf spots are stated to consist of a necrotic centre and a marginal zone, the former being the seat of the heaviest injury and the latter representing the struggle for supremacy between the host and the parasite or physiological factor responsible for the lesion.

The macroscopic and microscopic features of a large number of leaf spots caused by fungi, bacteria, insects, and injurious substances applied to the surface are described. In some of these spots, for instance in celery attacked by *Septoria apii*, peas by *Ascochyta pisi*, strawberries by *Mycosphaerella fragariae*, and in some cases of Bordeaux injury on apple leaves, the main changes in the tissues are the death and collapse of the cells, without any definite reaction of the host. In others due to various of the above-mentioned leaf-spotting agencies the tissues circumscribing the spot react by cell enlargement, cell division, and cell wall modification. In these cases the marginal zone may be broad and formed of two parts: a first or inner, nearest the centre, of enlarged cells with thin or variously thickened walls staining orange with Sudan III and evidently suberized or metacutinized, with intercellular spaces absent or filled with a substance staining like the walls, and with sometimes an inner tertiary thickening of the cell wall which gives the same reactions as lignified membranes (red with fuchsin or with phloroglucin and hydrochloric acid); and an outer of radial rows of cells shading off into the normal healthy tissues of the leaf. These radial rows of cells are formed by parallel divisions, tangential to the edge of the necrotic centre, in one or more layers of cells at a certain distance from the centre. As many as 11 of these walls may be formed in a single cell, and in most cases the walls of the new cells at some point towards the middle of the row are closer together than those on either side—whether nearer the centre or farther out. These narrow cells, which roughly correspond in position in neighbouring radial rows, are regarded as a phellogen. The cells of the row that lie on the side of the phellogen towards the centre of the spot give the same reaction with Sudan III as the cells of the first part of the zone and are regarded as a wound phellem, while those of the part of the row on the side of the phellogen towards the healthy tissues do not stain with the above reagents and are considered to be a wound phelloderm. The

phelloderm shades off into normal tissue through an area in which the cells are enlarged, without intercellular spaces, with little differentiation into palisade and spongy parenchyma, and occasionally divided by a single cross-wall.

The first divisions resulting in the formation of the cork cambium occur in scattered cells at a certain depth in the reacting tissue, and the dividing cells are hypertrophied. Each row may be the product of several cells, as in the 'polygeen cambium' described by Schoute (cf. Beyer, *Rec. Trav. Bot. Néerl.*, xxiv, 4, 1927) in *Ricinus* and other plants, but the cambial activity becomes restricted to the narrow cells towards the middle of the row, which cut off cork cells on one side and phelloderm on the other.

This type of reaction, with the formation of wound cork, between which and the necrotic centre there is a layer of large bladder-like suberized or metacutinized cells, was observed (amongst others) in ivy attacked by *Phyllosticta hedericola*, in cherry with *Clasterosporium carpophilum*, peach with spots due to burning from the presence of water drops, and cabbage exposed to tar vapours (when the upper epidermis and outer palisade cells are killed, but the deeper layers of the mesophyll react in the manner described).

In some cases no continuous cork cambium is formed, but the enlarged cells of the reacting zone are only divided here and there (bean with *Colletotrichum lindemuthianum*), or there may be no cell division, but only hypertrophy with a slight deposition of substances staining red with fuchsin or yellow with Sudan III (beet with *Cercospora beticola*). When tar vapour acts on cauliflower, unlike cabbage, there is no formation of phellogen, phellem, and phelloderm, but merely an enlargement of the deeper palisade cells, each of which forms a single wall: occasionally two parallel walls are formed, in which case the middle of the three resulting cells is the narrowest, as though there was a commencement of cambium formation.

The author points out that the first part of the reacting zone, when formed, resembles a callus, the outer cells of which (nearest the necrotic centre) are usually thin-walled and bladder-like and sometimes proliferate into the necrosed zone or into the galleries left by leaf-mining insects. But the cell walls showed the reactions of cork, and when thickened (as is often the case in the deeper layers next the phellem) the inner thickened layer gives reactions resembling those given by lignified walls, similar inner thickenings, giving the same reactions, being found in the neighbouring radially arranged rows of the phellem. Hence it is difficult, if not impossible, to distinguish this type of callus from wound cork. In intumescences on peach and begonia leaves due to too great moisture, a phellogen is formed in the deeper layers of the mesophyll, the cells between which and the lower epidermis give the reactions of cork.

Not only the cells of the mesophyll but also those of the epidermis and collenchyma may enlarge and divide as a result of the wound stimulus. Even lignified cells (e.g., the sclerenchymatous fibres of the veins) may become delignified, and cells of the endodermis and pericycle may enlarge and divide.

The type of reaction does not depend on the nature of the causal factor, but more on the duration of its action and on the inherent capabilities of the host cells. Thus, similar reactions were observed in cherry whether injured by *Clasterosporium* or by the insect *Coleophora*, in peach with the same fungus or with water drops, in cauliflower with *Bacterium maculicola* or with tar vapour. The reactions that occur are not new processes, all being similar in kind, though differing in time or place, to those found normally in the life of the plant.

A bibliography of 66 titles is appended.

CUNNINGHAM (H. S.). **A study of the histologic changes induced in leaves by certain leaf-spotting fungi.**—*Phytopath.*, xviii, 9, pp. 717–751, 10 figs., 1928.

A full account is given of the writer's investigations on the histological modifications induced in leaves by certain leaf-spotting fungi as well as by simple wounding. All the material used in the studies was collected near Ithaca, New York. The technique of the methods employed in the examination of the leaf tissues is described, and a review of the relevant literature is given.

The leaves of plum attacked by *Coccomyces prunophorae*, of cherry (*Prunus avium* and *P. cerasus*) infected by *C. hiemalis*, and of *P. virginiana* invaded by *C. lutescens* [ibid., v, p. 392], were found to form a definite cicatrice, namely, a band of healing tissue the cells of which are derived from division and enlargement of the mesophyll cells round the edge of the lesion, thereby isolating it. A similar reaction occurs in pear leaves attacked by *Mycosphaerella sentina* and in those of beet affected by *Cercospora beticola*. A periderm a good many layers in thickness is formed around the lesion. This is composed of a phellem of several layers, the large cells of which are both suberized and lignified. Next is a phellogen of one or two layers of cells with dense protoplasm and behind this several layers of phelloderm with peripheral protoplasm. Both these tissues have thickened walls of pure cellulose. The part of the cicatrice adjoining the healthy tissue consists of a few layers of somewhat enlarged, thin-walled living cells. All the tissues of the cicatrice are without intercellular spaces, and there is little differentiation between palisade and spongy parenchyma. Artificially wounded leaves of these plants react by the formation of a cicatrice similar to that produced as a result of fungous infection.

When celery leaves are attacked by *Septoria apii* the cells are killed, their contents disappear and the walls collapse, the necrosis shading off gradually into healthy tissue, without the appearance of a cork cambium. Similar conditions were found in the spots caused by several other species of *Septoria*, by *Cercospora circumscissa* on *Prunus serotina*, by *Phyllosticta fraxini* on *Fraxinus americana*, *Ramularia decipiens* on *Rumex crispus*, *Alternaria solani* on potato, *Pseudopeziza medicaginis* on lucerne, and other leaf-spotting fungi examined on various hosts. Leaves of *Fragaria virginiana* attacked by *M. fragariae* also showed no evidence of cicatrice formation, but wounded leaves of this plant formed a definite cicatrice round the edge of the affected portion, and the same occurred in some other cases that do not react to fungous in-

fection by the production of a cicatrice. The cell walls were usually unaltered when no cicatrice was formed, but suberization was observed in the walls of a few cells adjoining the inner edge of the collapsed areas in wounded leaves.

The results reported in this paper are considered to show that the limitation of the necrosis caused by leaf-spotting fungi is by no means always due to the formation of healing tissue within the host, but is governed by some other factor or factors requiring further investigation.

DAVIDSON (W. D.). **A review of literature dealing with the degeneration of varieties of the Potato.**—*Econ. Proc. Roy. Dublin Soc.*, ii, 22, pp. 331–389, 1928.

This survey of the literature on potato degeneration (a term defined as 'failure to produce a satisfactory yield even when the crop is grown under favourable conditions') extends from the middle of the eighteenth century to the present day. The references prior to 1905 are taken exclusively from works published in Great Britain or Ireland, and it is believed that hardly any of these have been cited in modern literature on the subject of degeneration.

The main conclusion drawn from a perusal of the relevant literature is that the salient facts regarding the etiology and control of degeneration diseases were recognized at an early date. Among other observations made during the late eighteenth and early nineteenth centuries were those relating to the beneficial effects of change of seed, the new supplies of which were to be procured from high cold situations; the necessity for the inspection of growing seed crops during July and the removal of diseased individuals; the gradual tendency of all varieties to degenerate; and the infectious and hereditary nature of curl or leaf roll, which is known to have caused heavy losses before 1770, and was early recognized to be associated with the presence of insects and the use of diseased seed.

A bibliography of 109 titles is appended.

DAVIDSON (W. D.). **The rejuvenation of the Champion Potato.**—*Econ. Proc. Roy. Dublin Soc.*, ii, 21, pp. 319–330, 1 pl., 1928.

An account is given of the writer's recent efforts (begun in 1922) to restore to its original vigour the Champion potato variety which is stated to have suffered from degeneration in Ireland since about 1885 [*R.A.M.*, v, p. 444]. The produce of the selected mosaic-free plants was specially tested for freedom from the disease by grafting one tuber of each plant into a healthy tuber of the susceptible President variety. No trace of mosaic was found, either in the progeny of these grafts or in that of the remainder of the tubers planted separately in Co. Donegal, in 1925 or 1926, but in 1927 a small proportion of the Scotch plants had to be removed on account of crinkle or intervenal mosaic.

In spite of the prevalence of blight [*Phytophthora infestans*] in 1927, the selected Champions remained green longer and withstood this disease better than any of the other locally grown varieties, including Up-to-date, King Edward, Arran Chief, Kerr's Pink, and Arran Victory. The rejuvenated stock showed a superior vigour

of the haulms, larger, flatter, and more uniformly dark green leaves, and a more even yield of good tubers than ordinary stocks. The average yield per acre of the selected stocks was 11 tons, 8 cwt., 3 qrs.

YOUNG (P. A.) & MORRIS (H. E.). **Witches' broom of Potatoes and Tomatoes.**—*Journ. Agric. Res.*, xxxvi, 10, pp. 835–854, 1 pl., 9 figs., 1 diag., 1928.

Extremely heavy damage is stated to be caused in Montana and Washington by witches' broom of potato, which was first investigated in 1915, and became increasingly prevalent from 1925 to 1928. The disease is also reported to occur in Russia [*R.A.M.*, vi, p. 746].

The primary symptoms of the disturbance include dwarfing and flavescence of the top leaves, which often show yellow margins; marginal flavescence and dwarfing of the leaflets; cylindrical development of the upper parts of the stems, with nodular swellings; rapid elongation of the stems; profuse branching of the tops; and the development of aerial tubers, basal sprouts, and numerous very small subterranean tubers. These symptoms intergrade with the secondary ones, which comprise flavescence and purpling of the tops; marginal flavescence and dwarfing of the leaflets; dwarfed, chlorotic, often simple leaves produced by the spindling tops and branches; development of many spindling axillary branches; slender, cylindrical stems with enlarged nodes; filamentous stems; spindling sprouts from tubers or stem bases; and the formation of aerial tubers.

Each seed-piece from affected tubers sends out 3 to 50 small, spindling stems with dwarfed and often simple leaves. The affected sprouts usually produce plants with many dwarfed, spindling, partly procumbent stems, 12 to 30 cm. in height. This prostrate form is the most common type of witches' broom, and has been observed in Montana nearly every year since 1915. The tubers produced by witches' broom plants have practically no period of dormancy, and senescence occurs later in diseased than in normal plants.

In 42 per cent. of the 142 trials made, witches' broom was transmitted by tuber-core grafts to eleven potato varieties. The disease was also transmitted twice by stem grafts, but leaf mutilation inoculations gave negative results, and no evidence was obtained of dissemination through the soil, or by root or leaf contact. The disease was not transmitted by aphids or mealy bugs (Coccidae).

Witches' broom was transmitted by inarch grafts from Russet Burbank potatoes to 17 Earliana tomatoes, from tomato to tomato, and back to potato. On tomatoes the chief symptoms of witches' broom (which has apparently not been previously recorded on this host) are flavescence of the tops; marginal flavescence of the leaflets; extreme stunting, curling, flavescence, and purpling of the leaflets; partial or total absence of leaf blades; spindling; flavescent axillary branches; and small, insipid fruit. The margins of affected tomato leaves were excessively thin and the palisade cells were found to be abnormally short and deficient in chlorophyll.

ERIKSSON (J.). **Potatiskräftan fanns i Sverige redan hösten 1912. Formalinlösning ett effektivt kampmedel.** [Potato wart already observed in Sweden in the autumn of 1912. Formalin solution an effective means of control.]—*Sydsvenska Dagbl. Snällposten*, 227, p. 5, 20th August, 1928.

A popular account is given of the present status of the potato wart [*Synchytrium endobioticum*] problem in various European countries and the United States, together with a short history of the development of the disease since its discovery in 1896. When the fungus was originally detected in Sweden in the autumn of 1912 [*R.A.M.*, ii, p. 422], on seed potatoes imported a year or two earlier from Germany, the expenditure of a sum of Kr. 4,000 was officially authorized for the purpose of eradicating it. Excellent results were obtained on this occasion by burying the diseased tubers in a trench, soaking the entire lot (348 l.) in 100 l. of paraffin, and finally covering them with a layer of sand 1 m. in thickness. Subsequently the carts, implements, workmen's boots, &c., were disinfected with formalin solution. In 1913 experiments showed that infected soil could be sterilized by watering with 1 per cent. formalin [cf. ibid., v, p. 182].

It is suggested that similar methods should be applied to check the present outbreak [ibid., viii, p. 56], combined with the selection of immune varieties. In the writer's opinion, the chief defect of the legislative measures now in force against wart disease is that they are directed almost exclusively towards the restriction of imports, leaving the export trade unaffected. Hence the extensive spread of infection during the last decade.

Potatiskräftans bekämpande. [The control of Potato wart.]—*Landtmannen*, xi, 36, p. 718; 43, p. 842, 1928.

The Swedish Government has allotted the sum of Kr. 5,000 to be administered by the Botanical Department of the Central [Agricultural] Institute, for the institution of control measures against potato wart [*Synchytrium endobioticum*: see preceding abstract]. The scope of the proposed activities in this direction is briefly outlined. Application has been made by the Central Institute for a further grant of Kr. 15,000 for the control of potato wart, and for Kr. 50,000 for plant protection in general, with special reference to wart disease.

LEUFVÉN (G.). **Åtgärder mot Potatiskräfta i Tyskland.** [Precautions against Potato wart in Germany.]—*Landtmannen*, xi, 37, pp. 734–735, 1928.

After a brief general survey of the precautionary measures adopted in Germany against the spread of potato wart [*Synchytrium endobioticum*], the writer presents some data (obtained from the Biologische Reichsanstalt and the Potato Growers' Association) concerning the results of recent tests of new varieties at five stations (seven in 1928). The most promising wart-resistant varieties are listed as follows: Juli, Kuckuck, Lichtblick, Rosafolia (early); Ackersegen, Erdgold, Modrow's Johannsen, Jubel, Preussen, and Tannenberg (medium-late); and Parnassia, Hellena, and Paul Wagner (for industrial purposes and fodder) [cf. *R.A.M.*, viii, p. 15].

Attention is drawn to the desirability of introducing these varieties, especially Ackersegen and Erdgold, into Sweden.

EGLITS (M.). **Novērojumi par Kartupeļu šķirņu attiecibām pret Actinomyces kraupjiem no 1925–1927 g.** [The infection of different Potato varieties by *Actinomyces* during the years 1925 to 1927.]—*Rept. Latvian Inst. Plant Protect. 1927–28*, pp. 9–10, 1928.

A table is given showing the reaction of 44 potato varieties to infection by *Actinomyces* [*scabies*] in Latvia during the period 1925 to 1927, inclusive. Among the resistant varieties may be mentioned Arnica, Arran Comrade, Blücher, Centifolia, Deodara, Great Scot, Hindenberg, Juli, Model, Parnassia, and Pirola. Beseler, Industrie, Königsniere, Majestic, Pepo, and Roode Star were very susceptible, and a number of others, including Thiele's Früheste, Ideal, Kaiserkrone, Kuckuck, and Primel, moderately so.

GRATZ (L. O.) & BONDE (R.). **Infection of Potato tubers by Alternaria solani in relation to storage conditions.**—*Maine Agric. Exper. Stat. Bull.* 187, pp. 167–182, 8 figs., 1927. [Received December, 1928.]

The lesions produced on potato tubers by the early blight fungus, *Alternaria solani* [*R.A.M.*, vi, pp. 436, 506], are dark, sunken areas of varying shape, sometimes surrounded by irregular, raised purplish or gunmetal-coloured borders. At the time of dispatch these lesions are relatively small, and are mostly hidden by the adhering soil, so that their detection at this stage is difficult. Hence the diseased condition of the tubers is frequently not discovered until they reach their destination. The *Alternaria* rot has been observed for some years past on Spaulding Rose tubers sent to Florida from Maine and other States, the trouble being especially prevalent among the very early consignments. The Early Rose, Green Mountain, Irish Cobbler, and Bliss Triumph varieties are also somewhat susceptible. The results of observations and experiments [which are described and tabulated] showed that the optimum temperature for the development of the lesions is 13° to 16° C., with a minimum at 5° to 7° and a maximum below 25°. The tubers were readily infected at digging time by exposing them to contamination from diseased foliage. The conditions of the Maine storage houses are stated to be ideal for the development of *A. solani* during October. No definite control measures have yet been evolved.

TUTEFF (I.). **Ein Versuch zur Bekämpfung der Fleckenkrankheit des Reises.** [An experiment in the control of the spot disease of Rice.]—*Zeitschr. für Pflanzenkrankh. und Pflanzenschutz*, xxxviii, 9–10, pp. 279–284, 1928.

The annual production of rice in Bulgaria is stated to amount to 8,508,567 kg., a large proportion of which is exported. In view of the great importance of this crop, the increasing prevalence of the 'spot' disease or 'brusone' [*Piricularia oryzae*: *R.A.M.*, i, p. 343; vii, p. 266] has caused much concern. An experiment [full details of which are given] was accordingly carried out at the

Sadovo Experiment Station to determine the value of seed disinfection with kalimat B in the control of this disease.

Seed of the indigenous Pembe variety (which constitutes 76·6 per cent. of the total crop) was treated as follows. One lot was steeped in a 0·5 per cent. solution of kalimat B for one hour after 23 hours' pre-soaking, while another was immersed in the same preparation at 0·2 per cent. for 24 hours. The latter treatment gave the better results, reducing the incidence of infection to a minimum and effecting a considerable increase in the yield. A marked stimulatory action also resulted from the process.

HOLLAND (T. H.). **The brown bast exhaustion theory experiment.** —*Trop. Agriculturist*, lxxi, 1, p. 55, 1928.

From 1st April, 1926, 103 previously untapped *Hevea* rubber trees were tapped by two cuts, each one-third of the circumference of the tree in length, from one of which, referred to as X, the rubber was collected in the usual way, while to the other, or Y cut, methylated spirit was applied immediately after tapping, to coagulate the latex and check its flow [*R.A.M.*, v, p. 581]. All the cuts were tapped daily. From June, 1926, to 31st March, 1928, the total amount of latex withdrawn from the Y cuts was only 37 per cent. of that from the X cuts, yet on 9th May, 1928, 56 per cent. of the latter and 55 per cent. of the former were affected with brown bast. This is considered to indicate that the withdrawal of latex does not affect the incidence of the disease [ibid., iv, p. 187].

GANDRUP (J.) & S'JACOB (J. C.). **Resultaten der proeven over meeldauwbestrijding op de onderneming Kroewoek in 1927.** [Results of the experiments in mildew control on the Kroewoek estate in 1927.]—*Arch. voor Rubbercult. Nederl.-Indië*, xii, 9, pp. 507–539, 6 figs., 1 diag., 1928. [English summary.]

During the second half of the east monsoon of 1927 a series of experiments in the control of rubber mildew (*Oidium*) [*heveae*: *R.A.M.*, vii, p. 598] was instituted by the Besoeki Experiment Station, Java.

Three plots, each covering an area of 0·7 hect. and containing about 130 trees, were sprayed with Bordeaux mixture (2 kg. copper sulphate, 1·5 kg. lime, and 200 l. water); three with Burgundy mixture (2 kg. copper sulphate, 2·4 kg. soda, and 200 l. water); and three with sulfinette [MacDougal, Manchester: ibid., vi, p. 690]. The fungicides were applied by means of eight Vis suction pressure pumps supplied by the Smeroe factory, Malang.

During the experiments an examination was made of 43 trees sprayed with Bordeaux mixture, 35 with Burgundy mixture, 33 with sulfinette, and 30 untreated. It was found that all the trees left untreated or sprayed with Bordeaux mixture, and all but two of those receiving Burgundy mixture were infected. On the other hand, only four of the trees sprayed with sulfinette showed infection. Subsequently about 100 leaves from every tree in young leafage were examined for mildew, and here again sulfinette proved greatly superior to the other preparations used (only 2 per cent. infection compared with 25 and 22 per cent. for Bordeaux and Burgundy mixtures, respectively, and 26 per cent. for the control).

The number of heavily infected trees with weak, thin crowns and an almost entire absence of leaves was considerably larger in the plots treated with the standard fungicides than in those where sulfinette was used. In consequence of severe burning, it was found necessary to reduce the concentration of sulfinette from 2·5 per cent. (as prescribed) to 0·5 per cent.

An experiment on a smaller scale was also carried out with ground sulphur mixed with water (4 kg. per 200 l., with the addition of 4 l. resin-soda as an adhesive). A reduction of infection from 11·9 to 2·5 per cent. was obtained, indicating that the possibilities of this form of treatment are worthy of further investigation.

In a series of experiments in which the leaves were inoculated with *O. heveae* after treatment with Bordeaux mixture, sulfinette, or sulphur dust, the first-named preparation failed to prevent infection, while the other two gave satisfactory results. Even when the leaves were not in direct contact with the sulphur but were merely near treated leaves the fungus was killed, presumably by the action of volatile products.

A resin-soda solution (2 kg. resin, 1 kg. soda, and 10 l. water) was found to be the best adhesive, 2 per cent. soap or molasses being less effective, but it induced burning of the foliage when added to fungicides of standard strength, and it is recommended, therefore, that Bordeaux mixture should be reduced to less than half the normal concentration and sulfinette to 0·25 per cent.

Discussing the economic aspect of spraying for the control of rubber mildew, the authors point out that the present cost of the operations could be reduced from Fl. 24 [about £2] per hect. for one application of sulfinette to rather less than half by the provision of pumps with a larger spraying capacity. Even the latter expenditure, however, is only justifiable in cases of severe injury.

[An English summary of this paper appears in *Bull. Rubber Growers' Assoc.*, x, 11, pp. 743–746, 1928.]

Brierley (W. B.), Jewson (S[ibyl] T.), & Brierley (Mrs. M.). **The quantitative study of soil fungi.**—Reprinted from *Proc. & Papers First Internat. Congress of Soil Sci.*, iii, 24 pp., 7 graphs, 1927. [Received December, 1928.]

In the present paper the writers discuss the quantitative technique of the mass extraction of soil fungi, an investigation of which has been in progress for some time at Rothamsted [*R.A.M.*, vii, p. 740]. The following processes are considered *seriatim*: sampling, suspension, disintegration, dilution, plating, incubation, and enumeration.

The examination of ordinary arable and grass-land, and of the Rothamsted Broadbalk and Park grass plots has shown that, even in such presumably homogeneous soils as the two latter, the fungi may be very unequally distributed in closely adjacent areas.

To eliminate errors of selection it has been found advisable to take at least six samples of 200 to 250 gm. each from the area to be tested, mixing them thoroughly, dividing the heap vertically into two, again mixing and dividing one-half, and finally using 25 gm. of the remaining moiety for making the suspension. A

second 25 gm. is weighed and dried at 100° C. to ascertain the moisture content.

Irregular but very considerable variations are found in the number of fungi in comparable samples of soil stored moist in closed bottles, the quantities showing a tendency to increase during a year's retention. In thoroughly air-dried samples the variations were slighter and the number of fungi showed a general tendency to decline during a year's storage. The most consistent results are obtained from air-dried soil kept in a loose, well-aerated condition on platters under bell-jars in a cool place.

In an experiment conducted to ascertain the best ratios of amount of sample to amount of liquid to volume of container, the most satisfactory results were obtained with 25 gm. of soil suspended in 250 gm. of water in a Roux culture bottle of one litre capacity. Standing for periods up to four hours was found to make no appreciable difference to the final number of colonies on the plates, but after this time a variable increase usually occurs which rapidly destroys the value of the suspension. The disintegration of the soil in the liquid to produce a fine and homogeneous suspension may be effected by some form of standardized shaking. Hand shaking for 20 minutes at a rate (standardized by metronome) of 120 per minute was generally adopted with good results.

The primary suspension of 1/10 must be diluted before it can be used as inoculum, and for this purpose a dilution of 1/20,000 has been found most generally convenient. One of the most critical factors in plating is uniform distribution of inoculum, and the best ratio for use with plates of 9 cm. diameter appears to be 1 c.c. of dilution to 10 c.c. of medium. A sufficiently high degree of consistency for all ordinary purposes is obtained by the use of eight plates per series. Of the 13 natural and synthetic media tested, Conn's glycerine-sodium asparagin medium adjusted to a hydrogen-ion concentration of P_H 4·5 to 5·7 gave the most generally satisfactory results. A temperature of 24° to 25° was found to be the most suitable for incubation.

Attention is drawn to the necessity for extreme accuracy in counting the colonies on the plates, and a method of rapidly distinguishing between fungi, actinomycetes, and bacteria is briefly outlined.

FERRARIS (T.). **Il seccume delle foglie di Cavolfiore.** [Leaf spot of Cauliflower.]—*Curiamo le Piante!*, vi, 9, pp. 168–170, 1 fig., 1928.

Black leaf spot (*Alternaria brassicae*) causes much defoliation of cauliflowers during wet autumns in Italy, being most severe on apparently vigorous plants which have received generous applications of organic fertilizers. The author recommends that in early autumn a little mineral superphosphate should be placed at the foot of the plants, to increase their vigour, that the lower leaves (which are likely to be infected first) should be cut away, and the plants dusted with 1 per cent. Caffaro powder or sprayed with a solution of 1 kg. copper sulphate, 1 kg. slaked lime, and 250 gm. ammonium chloride in 100 l. of water. Infected leaves should be removed and destroyed.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, ii, 2, p. 80, 1928.

RUMANIA. An Order dated 14th March, 1928, restricts the importation of potatoes from countries in which wart disease [*Synchytrium endobioticum*] is present and from contiguous countries. In the former case (comprising Great Britain, Ireland, France, Finland, Denmark, Switzerland, Norway, Poland, Sweden, Czecho-Slovakia, and the Netherlands), consignments must be accompanied by a duly authenticated certificate stating whether or not the disease occurs within a radius of 20 to 25 km. from the place of production. Potatoes imported into Rumania from the latter group of countries (including Austria [but see *R.A.M.*, vii, p. 815], Hungary, Spain, Luxemburg, the U.S.S.R., Bulgaria, and Jugo-Slavia) must be accompanied by a similar certificate vouching for the fact that wart disease does not occur in the region of production.

SPAIN. As from 27th June, 1928, the importation of potatoes is limited to consignments accompanied by a duly authenticated certificate vouching that wart disease (*S. endobioticum*) does not occur within a radius of 20 km. from the place of production.

Cuarantena exterior numero 9, prohibiendo la importación de vástagos de Caña de Azucar. [Foreign quarantine No. 9, prohibiting the importation of Sugar-cane cuttings.]—*Bol. Mens. Ofic. Def. Agric. Estados Unidos Mexicanos*, ii, 8–9, pp. 420–421, 1928.

In order to prevent the introduction into Mexico of certain sugar-cane diseases, including sereh, smut (*Ustilago sacchari*) [*U. scitaminea*], downy mildew (*Sclerospora sacchari*), and eye spot (*Helminthosporium sacchari*), the importation of sugar-cane cuttings from abroad is absolutely prohibited, except for the purposes of scientific research, when a special permit must be obtained. This regulation came into force on the day of its publication in the *Diario Oficial* (10th October, 1928).

The Plant Pest and Disease Ordinance, 1921 (No. 38 of 1921). The Plant Pest and Disease (Coffee) Regulations, 1928.—Tanganyika Territory, Govt. Notice No. 139, 4 pp., 1928.

An Order of 25th September, 1928 (which may be cited as the Plant Pest and Disease (Coffee) Regulations, 1928), defines the conditions governing the introduction into, and transit through, the Tanganyika Territory of coffee plants, berries, or beans. In order to prevent the spread of a given coffee pest or disease from any specified area, the removal of coffee plants or parts thereof may be subject to certain precautions under the supervision of official inspectors, who are further authorized to enforce the prescribed measures for the control of a pest or disease. Provision is made for the specification of notifiable pests and diseases, and the Order further requires that the owners or managers of coffee plantations shall notify any other serious pest or disease observed by them and take steps for its eradication.

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DIXON (DOROTHY). **The micro-organisms of cultivated and bush soils in Victoria.**—*Australian Journ. Exper. Biol. & Med. Sci.*, v, 3, pp. 223–232, 1 pl., 2 graphs, 1928.

The composition of the fungous flora in cultivated orchard and virgin bush soil of the Silurian area near Melbourne was examined and compared. Samples of soil were collected from March to October, 1927, and during February and March, 1928. The methods of sampling, plating, counting, and isolation are described and the results tabulated and discussed.

The chief genera of fungi represented were *Penicillium* in the bush and *Mucor* in the orchard. Undetermined species of *Mortierella, Absidia, Fusarium, Alternaria, Aspergillus* (*candidus, fumigatus*, and *flavus-oryzae* groups), *Trichoderma, Monilia, Macrosporium*, and other genera were also found. A fungus apparently identical with *Basisporium gallarum* [*Nigrospora sphaerica*: *R.A.M.*, vi, p. 758] was also isolated from orchard soils.

A general correlation was observed between the prevalence of the fungi and rainfall and temperature. Growth and reproduction were slightly impeded in the coldest month (June) and in the driest one (April) [cf. ibid., vii, p. 740].

DUCOMET [V.], FOËX [E.], MILLASSEAU, RIOLS, & SELARIES. **Traitement du mildiou du Houblon.** [Treatment of Hop mildew.]—*La Vie Agric. et Rurale*, xxxii, 16, p. 254, 1928.

Hops are apparently exposed to two methods of infection by mildew [*Pseudoperonospora humuli*: *R.A.M.*, vii, p. 671], namely, the internal invasion of the young shoots by the mycelium overwintering in the stock, and external infection from oospores which have hibernated in or on the soil.

In 1925 soil treatment with sulphuric acid gave good control in Burgundy in cases where the mycelium had not penetrated the tissues, but to obtain the best results a fungicidal treatment should be applied to the entire plant and not merely to the base.

The following is a summary of the authors' recommendations for the treatment of hop mildew. At pruning time all débris (especially

the cones) should be collected and burnt, the stocks being sprayed with 2 per cent. neutral Bordeaux mixture. As soon as the spiked shoots begin to appear, they should be cut back as near as possible to the point of insertion. Copious applications of Bordeaux mixture (1·5 per cent.) should precede and follow this operation. All infected terminal and axillary shoots should be nipped off, this process also being preceded and followed by treatment with Bordeaux mixture as above. Every 10 to 15 days liberal applications of a copper-containing fungicide should be given until the cones are formed. All wild hops, on which the attack often originates, should be destroyed.

The use of resistant varieties appears to be a promising method of control, but hitherto no definite observations have been made in this direction. In Belgium the Hallertau variety has shown greater susceptibility than the native ones. The 'white stem' is also susceptible while the 'green stem' of Buvrinnes is more resistant. In the Aesst region the Cuignenu variety is reputed to be more resistant than Clochette verte or Groene bel, while the Striesslspalt seems worthy of attention in Bavaria.

BLATTNÝ (C.). **O některých chorobných zjevech u zdřevnatělých částí Chmele a u mladých výhonů.** [Notes on certain pathological phenomena in the woody parts and young shoots of the Hop.]—*Český Chmelař* [*Bohemian Hop-Grower*], Žatec [Saaz], i, 23, pp. 189–191; 24, pp. 200-202; 26, pp. 214–215; ii, 1, pp. 2–3; 6, pp. 45–46; 7, pp. 49–51, 12 pl., 1928.

This paper was compiled in connexion with proposed legislative measures in Czecho-Slovakia for the purpose of prohibiting the use of diseased or injured cuttings or setts in planting new hop gardens. It describes the most important physiological, insect, and fungous diseases of hop setts and rootstocks observed by the author, among which the following are of mycological interest. Tumours of hop rootstocks caused by *Pseudomonas* [*Bacterium*] *tumefaciens* occasionally occur in Czecho-Slovakia, especially on heavy, damp soils. This organism may also have been responsible for a remarkable proliferation of adventitious buds at the crown of two hop plants which was seen in 1927 in Saaz. In both cases the crowns had assumed the aspect of a confused structure, several kilogrammes in weight, consisting of a dense intertwining of thin, brittle, and partly dead twigs; no parasitic organism could be isolated from the tissues of this malformation, but some of the vines of the preceding year's growth bore small tumours which the author thinks were undoubtedly caused by *Bact. tumefaciens*.

In heavy and waterlogged soils, especially in wet years, the rootstocks are frequently rotted by wood-destroying fungi, e. g., species of *Polyporus* and *Trametes*. During the exceptionally rainy month of June, 1926, several cases were recorded in which the young shoots of cuttings planted in wet soil were severely attacked and killed by *Botrytis cinerea* [*R.A.M.*, vi, p. 53]; in some instances the woody tissues of the cuttings were also penetrated by the mycelium of the fungus. In the following two years, when the weather conditions were more normal, the fungus failed to reappear in these areas. The fact that in 1928 a species of *Verticillium*

was the only organism which could be isolated from a few hop plants suffering from wilt leads the author to believe that this fungus was the cause of the disease, although its pathogenicity to hops was not tested by inoculation [cf. ibid., vii, p. 616].

Considerable space is devoted to bacteriosis and diseases caused by species of *Fusarium*, which appear to be of outstanding importance in Czecho-Slovakia. Detailed descriptions are given of the symptoms caused by these organisms on the rootstocks, vines, cuttings, and shoots of the hop, and also of inoculation experiments made with them. In stocks, vines, and cuttings the main symptom of bacterial disease is a characteristic brown discoloration of the pith and adjacent tissues, which progresses from the base upwards and eventually involves the newly formed wood. The point of entry is usually a wound in the underground portions. The early stages of the disease are marked by the stunting and gradual wilting of the shoots, which eventually die, when the pith of the infected basal parts becomes reduced to a thick, slimy mass associated with the destruction of the cell walls and protoplasm. Besides other organisms, the author isolated from the pith in all stages of disease a bacterium which he showed to be the primary cause of the infection by successful inoculations. The organism is ovoid, 2 by 1 μ in diameter, staining deeply with all the usual dyes, and growing well at a temperature of about 20° C. on ordinary media, e. g., malt agar, on which it forms thin, greyish-white, superficial colonies; it does not liquefy gelatine, and imparts a straw colour to colourless substrata. In no case was the bacterium found in the tissues of the wilting or dead shoots or leaves, and inoculations with the filtered liquid from pure cultures which were killed by exposure to a temperature of 65° C. showed that the wilting and death of these organs is caused by a toxin secreted by the bacterium and acting far in advance of it. It is pointed out that cases of pure bacterial infection are very rare in Czecho-Slovakia, as in the vast majority of cases it is associated with species of *Fusarium* or *Verticillium*, which rapidly outgrow the original infection and completely mask the symptoms. The chief danger of the bacterial infection is that it affords an easy access to these secondary organisms which kill the plants much more rapidly than the bacterium alone. The latter is a soil-inhabiting organism and is stated to be widely distributed throughout the country. The main means of control should consist in regular tillage and drainage of the soil, and in abundant applications of mineral fertilizers.

The *Fusarium* diseases of hops are dealt with under five headings. (1) Canker or growing off [ibid., v, p. 126] mainly attacks the older wood of the crown, and is caused by a species of *Fusarium* distinct from the one held responsible for a similar disease in England [ibid., iv, p. 634]. In pure culture this species is characterized by a profuse growth of dense, white, aerial mycelium, an abundant production of microconidia, and a very sparse development of macroconidia which begin to form only in two-month-old cultures. The macroconidia are very slightly curved, indistinctly constricted at the base, 3-septate (very rarely 4-septate), and measure 39 to 51 by 5·5 to 7·5 μ. This disease is stated to occur very seldom in Czecho-Slovakia, and chiefly on heavy and wet soils or in very

rainy seasons. (2) Wilting or tracheomycosis of young shoots causes a wet withering of shoots and leaves (quite distinct from the desiccation of these organs caused by bacteriosis). The first serious outbreak of this disease was recorded in Czecho-Slovakia in the exceptionally rainy year 1926, but since then it has reappeared each year, although to a lesser extent. It is caused by two species of *Fusarium* (either singly or in association with each other), the pathogenicity of which was proved by artificial inoculations. The first, which is the most frequently found, is characterized in pure cultures by 5-septate (very exceptionally 4-septate), strongly curved macroconidia which are much constricted at the base and measure 23 to 39 by 5 to 6·5 μ (average of 500 measurements 33·5 by 6·5 μ); it forms chlamydospores readily. The other species forms in culture a very sparse, white, aerial mycelium, light pink sporodochia, and few or no microconidia. The majority of the macroconidia are 3-septate, rather curved, with a pronounced foot at the base, and 16 to 30 by 4 to 5 μ in diameter. (3) Fusariosis of one- or two-year-old wood is caused by all the species described above. (4) Fusariosis of the roots is caused by the species to which canker is due. (5) Fusariosis of the above-ground organs is mainly caused by the 5-septate wilt-inducing species. The control of these diseases should consist in the removal and destruction of all infected plants, the use of healthy setts in planting, and the dipping of the cuttings in Bordeaux mixture before planting.

The selection of Sugar Cane varieties for planting purposes.— *Planter and Sugar Manufacturer*, lxxxi, 13, pp. 246–247, 1928.

This article, largely based on a paper by F. S. Earle in the 1928 issue of the Reference Book of the Sugar Industry of the World, describes a classification of sugar-cane varieties by groups, according to their lines of breeding and their descent from the original wild species.

The first, or *Saccharum officinarum* group consists of the thick tropical or noble canes. These require good lands and good cultivation, as on poor lands they suffer badly from disease, especially root rot; all are susceptible to mosaic. Amongst the best known seedlings of this group are H 109, B.H. 10 (12), and S.C. 12 (4).

The second, or *S. sinense* group consists of the so-called Chinese or Japanese canes, of which Uba is a typical example. They thrive on land too poor or too dry for the noble canes. They all tend to late maturity, show great resistance to root disease, and are almost completely immune from mosaic.

The third, or *S. barberi* group consists of slender hybrid canes carrying half of the typical north Indian *S. barberi* blood. The best known varieties of this group are the slender P.O.J. canes. They are strongly resistant to root disease and variously tolerant of mosaic.

The fourth group, which promises to become the most important, carries some portion of the blood of the wild cane of the East Indies, *S. spontaneum*, and sharp sub-divisions must be made according to the proportion of wild blood present. The half-breed canes, including Kassoer, appear to be completely resistant to root disease.

Hybrids of Kassoer with noble canes, giving one-quarter wild blood, have shown much better commercial possibilities, while by further reducing the wild blood to one-eighth, a later series of P.O.J. canes has been raised which resemble noble canes in appearance but have a vigorous root system and are highly resistant to mosaic. They form the 2,700 and 2,800 series of P.O.J. canes [cf. *R.A.M.*, vii, pp. 403, 743; viii, p. 62]; all of these can take mosaic, but infections are rare and usually not over one per cent. This group can be used in heavily infected areas and kept free from mosaic with a minimum of roguing.

U.S. plant explorers in New Guinea find many new Sugar Cane varieties.—*Planter and Sugar Manufacturer*, lxxxi, 12, pp. 239–240, 1928.

Dr. E. W. Brandes, the leader of the American party which recently explored New Guinea and Papua for disease-resistant varieties of sugar-cane [*R.A.M.*, vii, p. 672], has notified the United States Department of Agriculture that the search yielded 167 varieties, including a hard, straight cane nearly 33 ft. high, which proved to be a new species. Cuttings of each variety will be sent to the United States in refrigerators and kept under observation. Duplicate cuttings are also to be planted at Sydney.

Sugar Cane hunters return from New Guinea.—*Planter and Sugar Manufacturer*, lxxxi, 17, p. 321, 1928.

The leader of the recent American expedition to New Guinea [see preceding abstract] is stated to have returned to the United States with cuttings of 221 varieties of two different species of sugar-cane. Confidence is felt that specimens have been collected of wild canes which are the ancestors of cultivated varieties grown throughout the world. Most of them show the botanical characteristics of the cultivated noble canes.

A duplicate set of all the cuttings was planted by the Queensland Department of Agriculture; one consignment is now growing satisfactorily in America, and a further one was brought home by Dr. Brandes.

Bell (A. F.). **Bureau of Sugar Experiment Stations. Disease survey of the Beenleigh district.**—*Queensland Agric. Journ.*, xxx, 3, pp. 188–190, 1928.

In January, 1927, an inspection showed that throughout the whole district of Beenleigh, Queensland, approximately 10 per cent. of the sugar-cane was affected with Fiji disease [*Northiella sacchari*], the losses being estimated at 8 to 10 per cent. of the crop. Further inspections were made in 1928 and by July of that year it was estimated that infection had been reduced by the control measures adopted to less than 2 per cent. In this area Fiji disease remains the commonest and most destructive disease of sugar-cane, D. 1135, Purple Top (N.G. 64), and Green Baruma canes were badly affected wherever grown; the most resistant canes are Q 813 and H.Q. 285 (Milton).

SHEPHERD (E. F. S.). **La maladie soupçonnée être le 'Pokkah bong'.** [The disease suspected of being 'pokkah boeng.']—*Rev. Agric. de l'Île Maurice, 1928*, 41, p. 207, 1928.

The symptoms now attributed to the 'pokkah boeng' disease [*R.A.M.*, vii, p. 200 and next abstract] are stated to have been observed on Mauritius sugar-canes since 1915. One of the stages of the disease is believed to correspond to the condition known as bunchy top and another to that described as knife cut [ibid., iii, p. 686; v, p. 697]. Pokkah boeng does not appear to cause serious losses and it has not been found to be transmissible by infected cuttings.

ORIAN (G.). **Le 'Pokkah-bong' de la Canne à Sucre.** ['Pokkah boeng' of Sugar-cane.]—*Rev. Agric. de l'Île Maurice, 1928*, 41, pp. 208–213, 8 pl., 1928.

A full description is given of the various stages of the 'pokkah boeng' disease of sugar-cane in Mauritius [see preceding abstract]. In mild attacks the leaves may either be interlaced or folded over transversally. In the former case the plants generally recover, but in the latter the leaves do not unfurl normally and often remain stunted, with their tips divided like the teeth of a comb. The midribs sometimes show a pronounced lateral curvature, and a whitish-yellow discoloration, resembling that due to gummosis [*Bacterium vascularum*], may also be apparent. In more serious cases the leaves present a translucent, yellowish-white aspect, often deepening to purple near the sheath, and are further characterized by longitudinal or oblique folds. Normal growth is resumed after a time, but the stem remains more or less stunted.

The bacterial rot sometimes associated with pokkah boeng attacks the youngest leaves in the centre of the head. In some cases only certain parts of the leaves are affected, and the plants later assume an irregularly jagged appearance. The sheaths may also be blackened and eaten away down to their juncture with the stem. Their inner surfaces also show more or less isolated spots through which the bacteria are believed to penetrate the surface of the stems or even to reach the internal tissues by way of the fibro-vascular bundles. The first green leaves formed by affected plants are much stunted and taper abruptly towards the apex; the internodes of the stem are also very short, sometimes curved, and occasionally show canker-like lesions where the tissues are decayed.

All the cane varieties grown in Mauritius appear to be susceptible to pokkah boeng, especially D. 109 and D.K. 74.

FARIS (J. A.). **Three Helminthosporium diseases of Sugar Cane.**—*Phytopath.*, xviii, 9, pp. 753–774, 1 col. pl., 5 figs., 1928.

From a perusal of the relevant literature and a study of infected material the author is led to conclude that the species of *Helminthosporium* causing eye spot of sugar-cane in Java, Hawaii, and the West Indies [*R.A.M.*, vii, p. 807] differs from *H. sacchari*, the cause of sugar-cane helminthosporiosis in India, in its longer, paler conidiophores and conidia, and from *H. stenospilum* Drechsler, the cause of brown stripe in Cuba [ibid., vii, p. 402], in having shorter conidia of a much lighter colour. The lesions produced by the three different species also possess very distinctive characters.

The *Helminthosporium* responsible for eye spot (which is named *H. ocellum* n. sp., with a diagnosis in English) produces Bordeaux red spots, with the colour of the centre much diluted at the edges, generally surrounded in the earlier stages by a marked halo. The 3- to 8-septate, smoky yellow-brown conidiophores measure 145 to 380 by 3·5 to 5 μ, and the 3- to 10- (average 6·7) septate, subhyaline, light smoky yellow-brown, slightly curved conidia 29 to 94 by 9 to 21 μ (average 69 by 12·7 μ). Germination normally occurs by means of a germ-tube from each end of the conidium. *H. ocellum* was collected by the author in Cuba, Porto Rico, and San Domingo, and in Florida by Drechsler and Bourne (1927). *H. sacchari* produces straw-coloured spots with red borders; the dark greenish-brown conidiophores measure 100 to 190 μ and the cylindrical or long-elliptical, olive-green to brown conidia 35 to 60 by 8·5 to 12 μ. The lesions formed by *H. stenospilum* are Vandyke brown with a narrow, yellowish-green halo; the dark olivaceous conidiophores measure 120 to 160 μ and the conidia 84 by 17 μ according to Drechsler, 54 to 131·6 by 11·3 to 18·8 μ (average 89·6 by 15 μ) in the author's cultures. The diagnostic characters of the three species concerned are presented in tabular form.

Eye spot [proper] is stated to be widely distributed in Cuba, where the writer's experience of varietal susceptibility agrees closely with that of Cook in Porto Rico [ibid., vii, p. 199]. The varieties most severely attacked during the winters of 1926–7 and 1927–8 were the Fajardo Central seedlings, F.C. 136, 214, and 306, and D. 109, while the widely grown Cristalina and a number of other varieties [which are listed] proved highly resistant. The selection of these varieties is recommended as the most effective control measure.

The disease flourishes on rapidly growing canes, and in cool, rainy weather, differing in this respect from brown stripe, which develops better on slowly growing canes during the dry period of July and August.

Brown stripe was observed in Cuba on the Cristalina, B.H. 10 (12), and S.C. 12 (4) varieties in the autumn of 1924 [loc. cit.]. A comparison of the causal organism with *H. ocellum* showed consistent differences in the growth characters on 1 per cent. sucrose agar. Inoculation of young plants grown under aseptic conditions by spraying with conidial suspensions of these two species of *Helminthosporium* showed striking differences between the types of leaf spotting produced. The reddish centres of the brown stripe lesions darkened and slowly elongated to a definite linear stripe up to 8 to 10 cm. long and 0·5 cm. wide, surrounded by a fairly uniform, yellowish-green halo. The lesions caused by *H. ocellum* remained brick-red, with indefinite margins and wide, irregular haloes, subsequently forming the typical peacock feather stripes described by van Breda de Haan for *Cercospora sacchari*, with which it is considered to agree fairly closely. The lesions caused by the two organisms also differ markedly in shape, those of *H. ocellum* being about one-quarter as wide as they are long, and those of *H. stenospilum* only about one-twentieth. The latter fungus sporulates very sparsely as compared with the former.

A table is given showing the relative susceptibility of the different

cane varieties to brown stripe in Cuba. The resistant group includes a number of P.O.J. and Co. strains as well as Uba and Kavangire. In view of the relatively innocuous character of this disease, which only becomes destructive during dry periods on cane of lowered vitality, no special control measures, other than attention to cultural factors, need be recommended at present.

LEE (H. A.) & MCHARGUE (J. S.). **The effect of a manganese deficiency on the Sugar Cane plant and its relationship to Pahala blight of Sugar Cane.**—*Phytopath.*, xviii, 9, pp. 775–786, 2 figs., 1928.

Pahala blight of sugar-cane [*R.A.M.*, vii, p. 271], which is named after the locality in the south of Hawaii where it was first observed and most commonly occurs, was originally described in 1906 by Cobb, who attributed it to the leaf-splitting fungus, *Mycosphaerella striatiformans*. It is not known to occur in other countries.

The most common symptoms are long, whitish, chlorotic streaks on the leaf blades, chiefly of the third, fourth, and fifth leaves from the youngest unfolded one. Later small, reddish spots (on which *M. striatiformans* is often found) develop along the white streaks, sometimes producing continuous reddish-brown streaks. In advanced cases the leaves of the affected plants split along the reddened streaks. The disease appears to occur exclusively on soils of a neutral or alkaline reaction.

Attention is drawn to the likelihood of confusion between Pahala blight and certain leaf mutations characterized by white streaks; with leaf scald [*Bacterium* sp.: ibid., viii, p. 64]; and with limestone and other forms of iron-deficiency chlorosis. The symptoms of these conditions are briefly indicated for differential purposes.

McGeorge has shown (*Hawaiian Planters' Record*, xxx, p. 293, 1926) that applications of sulphur to the soil (1 to 2 tons per acre) resulted in complete recovery of the canes from the Pahala blight in four to six weeks. He concluded that the disease is a physiological or nutritional disturbance induced by soil conditions. No correlation was found between Pahala blight and the presence or absence of iron in the leaves. In a series of experiments [details of which are given] instituted by Lee in Hawaii in 1925, iron sulphate, applied as a 20 per cent. dust to the leaves, caused a burning of the plants and failed to control the disease. On the other hand, the affected canes made a satisfactory recovery under the influence of the following leaf applications (especially the last): manganous sulphate in a 20 per cent. mixture in sulphur; the same (30 per cent.); and 20 per cent. manganous sulphate and 10 per cent. ammonium sulphate in sulphur. In 1926 Pahala blight was also well controlled at the Kilauea Sugar Company by dusting with 30 per cent. powdered manganous sulphate crystals in a sulphur carrier. The results of these experiments suggested that the disease was due to a deficiency of manganese in the soil, and the outcome of chemical analyses of normal and blighted leaves confirmed this hypothesis. There was only a trace of Mn in the blighted leaves compared with 0·003 per cent. in healthy ones. Sugar-cane cuttings in sand cultures without manganese developed the typical

symptoms of Pahala blight, while the controls receiving manganese produced luxuriant green foliage.

The manganese deficiency chlorosis of tomatoes in Florida [ibid., vii, p. 468] appears to be identical in character with Pahala blight, which might be renamed accordingly. As in the tomato chlorosis, the addition of organic matter to the soil alleviates Pahala blight, probably not only by the introduction of small quantities of available manganese, but also by slightly increasing the hydrogen-ion concentration and thereby making some of the soil manganese more readily available.

Considerable differences seem to exist among sugar-cane varieties in respect of their demand for manganese, those most susceptible to Pahala blight being active manganese feeders, while the resistant D. 1135 and possibly H. 109 require much less.

SYDOW (H.) & PETRAK (F.). **Micromycetes philippinenses. Series prima.** [Philippine Micromycetes. First series.]—*Ann. Mycol.*, xxvi, 5–6, pp. 414–446, 1928.

This first series of Philippine fungi collected by Mrs. Clemens is stated to represent only a fraction of the extensive collection submitted to the authors for identification. Of the 131 species enumerated, 22 are new, and among these [all of which are furnished with Latin diagnoses] are several species of the less common genera of the rusts.

SMALL (W.). **Further notes on Rhizoctonia bataticola (Taub.) Butler.**—*Trop. Agriculturist*, lxxi, 2, pp. 77–80, 1928.

Among the new hosts of *Rhizoctonia bataticola* (*Macrophomina phaseoli*) that have been recorded in Ceylon since the publication of the last list [*R.A.M.*, vii, p. 678], the following are of interest. A large number of *Citrus* seedlings (the majority of which were budded) in the Royal Botanic Gardens, Peradeniya, which were killed by a root disease, bore numerous sclerotia of *R. bataticola* in the cortex and on the wood of their tap-roots. In several cases the dying seedlings were attacked by *Diplodia* sp., which had entered at or near the budding wound. It is pointed out that the soil in which these seedlings grew was deficient in phosphoric acid, as also was the soil under the avocado pear trees which were killed by *R. bataticola* at the Experiment Station, Peradeniya [loc. cit.]. Two dead young cypress trees (*Cupressus lindleyi*) at Peradeniya bore numerous small sclerotia of *R. bataticola* in the cortical tissues and in the wood of all their roots. Sclerotia were also found in the cortical tissues and on the central vascular strand of the roots of a diseased areca palm (*Areca catechu*) in the Central Division of Ceylon. With regard to Mitchell's statement (*Trop. Agriculturist*, lxx, p. 325, 1928) that he had seen cases in which the mycelium of *Fomes lignosus*, associated with root disease of rubber, had spread along the roots of woody cover crops, and that he had frequently observed cases of attack of *F. lignosus* on *Crotalaria* used as a cover crop, the author states that on the diseased specimens of *Crotalaria* submitted to him by Mitchell he invariably found the presence on the roots of *R. bataticola* as well as of a white superficial mycelium which still has to be proved to be

that of *F. lignosus*. Wilted sunflower plants (*Helianthus annuus*) received from the Southern Division of Ceylon showed large numbers of sclerotia of *R. bataticola* in the bark and cortex of the stems at ground level, among which also occurred pycnidia of *Macrophomina phaseoli*, this being the second record for Ceylon of the occurrence of both stages of the fungus on the same host in nature.

MONTEITH (J.) & DAHL (A. S.). **A comparison of some strains of Rhizoctonia solani in culture.**—*Journ. Agric. Res.*, xxxvi, 10, pp. 897–903, 2 figs., 2 graphs, 1928.

The results of comparative cultural studies of *Rhizoctonia* [*Corticium*] *solani* from potato and of the *Rhizoctonia* isolated from grass injured by brown patch [*R.A.M.*, vi, p. 489] are fully described. The latter strain makes more rapid growth at 25° and and 30° C. than the former, but otherwise the morphological and physiological differences between the cultures are too variable to serve as diagnostic characters. It is concluded, therefore, that the brown patch strain of *Rhizoctonia* may be included within the species *C. solani*.

ANDREWS (E. A.). **On the incidence of insect pests and fungus diseases on Tea at Tocklai.**—*Quart. Journ. Indian Tea Assoc., 1928,* 3, pp. 173–177, 1928.

Further studies in connexion with the incidence of fungous diseases of tea in the experimental area at Tocklai [*R.A.M.*, vii, p. 542] showed that brown blight [*Glomerella cingulata*], red rust [*Cephaleuros parasiticus*], and *Cercospora* [*theae*] were all less prevalent on the plots receiving potash and phosphoric acid than on those not so treated. It was observed that careless pruning, the omission of cleaning out, and other cultural defects tending to cause the retention of poor and old wood in the bushes, involved a proportionate increase in the prevalence of brown blight and red rust. Pruning out the old wood so as to facilitate the admission of light and air to the bushes failed to reduce *C. theae*. So far the practice of hard plucking seems to diminish, rather than increase, the incidence of fungous diseases. The actual amount of damage done (as distinct from the prevalence of the fungi under discussion) is not considered in these studies.

HOLMES (F. O.). **Accuracy in quantitative work with Tobacco mosaic virus.**—*Bot. Gaz.*, lxxxvi, 1, pp. 66–81, 2 figs., 1 graph, 1928.

In this amplified description of his method for the comparison of various concentrations of the tobacco mosaic virus [*R.A.M.*, vii, p. 477], the author shows, by means of numerical data, that dilution to a given extent causes a decrease in infections when inoculations are made into test plants, this decrease depending only on the percentage dilution in the range studied and not on the original concentration of the virus.

A stock virus was made by expressing the juice from 100 or more mosaic Turkish tobacco plants into a glass bottle. By diluting with water, a virus content of one-half, one-fourth, one-eighth, and

so on, of that of the original sample was prepared. On inoculation into test plants, however, this did not give a reduction of infections to one-half, one-fourth, &c., of the original sample, the reduction being less than would be expected from the dilution and being dependent only upon the degree of dilution and not on the strength of the sample taken for dilution. Thus the mean reduction in the number of infections in each set of fifty test plants was 3·7 for a dilution of one-half, 7·5 for one of one-fourth, 11·2 for one of one-eighth, 15·3 for one-sixteenth, and 22·4 for one sixty-fourth. For the measurement of known dilutions 2,500 plants were used. By means of the resultant data [expressed in graphic and tabular form] it is possible to calculate from a formula the number of plants required to perform a given experiment when it desired to differentiate between two viruses of moderately different strengths, or to make an accurate comparison of two viruses.

Experiments are fully described in which these methods were applied to various aspects of the virus problem. It was found that the virus tends to die off somewhat rapidly in storage at 22° C., and also loses a high proportion of its efficacy (85 per cent. in six weeks) when frozen; that the yellow areas of mottled leaves provide a much better supply of virus than the adjacent green areas of the same leaves; and that green leaves above the point of inoculation may quickly become active sources of virus, while below this point apparently similar green leaves do not furnish appreciable amounts of virus until several weeks after inoculation.

WINGARD (S. A.). **Hosts and symptoms of ring spot, a virus disease of plants.**—*Journ. Agric. Res.*, xxxvii, 3, pp. 127–153, 23 figs., 1928.

A further investigation has been made, at the Virginia Agricultural Experiment Station, of the occurrence and symptoms of tobacco ring spot [*R.A.M.*, vii, p. 478] on a variety of hosts other than tobacco, as well as on a number of species and varieties of *Nicotiana*.

The author obtained infection on 38 genera in 17 families by swabbing their leaves with cotton plugs saturated in the fresh sap and macerated tissues of a Kentucky Yellow tobacco plant showing typical symptoms of ring spot. Among the plants contracting infection under these conditions were numerous species and varieties of *Nicotiana*; various other Solanaceae, including eggplant, *Datura stramonium*, *Petunia violacea*, *Physalis angulata*, and *Solanum nigrum*; and the following (among numerous other) members of various families: melon, watermelon, cucumber, vegetable marrow, aster (*Callistephus chinensis*), sunflower, lettuce, *Zinnia elegans*, *Dolichos lablab*, *Phaseolus vulgaris*, *P. lunatus*, *Vigna sinensis*, beet, *Viola tricolor*, *Ricinus communis*, *Hibiscus esculentus*, *Phytolacca decandra*, and *Antirrhinum majus*. Inoculation experiments on 42 other hosts [which are enumerated] gave negative results.

Some of the above-mentioned plants, e.g., several *Nicotiana* varieties, *D. lablab*, *V. sinensis*, *P. vulgaris*, *P. lunatus*, and *A. majus*, are often killed outright as a result of ring spot infection,

which has further been found to occur naturally on the commercial tobacco varieties and on *Melilotus officinalis*.

The first symptoms of ring spot appear about three days after inoculation, and infection becomes systemic some ten days later. In most cases the attack is confined to the leaves of the plants, but some hosts may also show infection of the stems (several tobacco varieties) and fruits (vegetable marrow).

N. tabacum has been infected with ring spot virus recovered from all the susceptible species of *Nicotiana* and from 16 other hosts [which are enumerated] belonging to various families.

KOTTE (W.). **Der Bakterienbrand des Tabaks als Sämlingskrankheit.** [The bacterial blight of Tobacco as a seedling disease.]—*Deutsche Landw. Presse*, lv, 36, p. 525, 2 figs., 1928.

Hitherto the bacterial blight or wildfire (*Bacterium tabacum*) [*R.A.M.*, vii, pp. 547, 548] has mainly affected older tobacco plants in Germany, but an inspection of the Baden fields in the spring of 1928 revealed the presence of the disease on seedlings also. It is thought that the obscure affection of tobacco seedlings described by Hoffmann in 1924 [ibid., iii, p. 613] was really due to *Bact. tabacum*. The infected plants are stunted and the leaflets develop a chlorotic, often almost lemon-yellow tinge; in slightly older seedlings the well-known circular chlorotic lesions appear. The disease spreads rapidly and may soon destroy the entire bed. The causal organism was isolated from the infected seedlings in all cases observed by the author. The disease is favoured by cold, wet weather, and the seedlings should be protected by glass or wire netting, as well as by the application of copper-containing fungicides.

WEBER (G. F.) & RAMSEY (G. B.). **Tomato diseases in Florida.**—*Florida Agric. Exper. Stat. Bull.* 185, pp. 61–138, 41 figs., 1926. [Received December, 1928.]

The symptoms, effects, etiology, and control of the principal fungous, bacterial, and physiological diseases of tomato in Florida are described in popular terms. The diseases include nailhead rust (*Alternaria solani*) [*Macrosporium tomato*: *R.A.M.*, v, p. 598]; *Fusarium* wilt (*F. lycopersici*); mosaic; soil rot (*Corticium vagum*) [*C. solani*]; bacterial spot (*Bacterium vesicatorium*) [ibid., iii, p. 119]; buckeye rot (*Phytophthora terrestris*); *Phoma* rot (*P. destructiva*); southern blight (*Sclerotium rolfsii*); brown rot (*Bact. solanacearum*); anthracnose (*Colletotrichum phomoides*); leaf mould (*Cladosporium fulvum*); late blight (*Septoria lycopersici*); stem rot (*Sclerotinia sclerotiorum* and *S. minor*); blossom-end rot; bacterial rot (*Bacillus carotovorus*, *B. aroideae*, and other organisms); downy mildew (*Phytophthora infestans*); *Fusarium* rot (*F.* spp.); *Botrytis* stem and fruit rot (*B.* sp.); *Oospora* rot (*O. lactis parasitica*) [ibid., vii, p. 306]; damping-off (*C. solani*, *Pythium de Baryanum*, *S. sclerotiorum*, and *F.* spp.); *Rhizopus* rot (*R. nigricans*); leaf roll; and various physiological disturbances, e. g., puffy tomato (the cause of heavy annual losses) and blossom drop, associated with unbalanced fertilizer relations.

The European Elm disease. A compilation of the more important available information.—*Bartlett Res. Lab. Bull.* 1, 2 figs., 2 diags., 4 graphs, 1928.

Miss Schwarz's and Wollenweber's papers on the Dutch elm disease in Holland and Germany, respectively [*R.A.M.*, ii, p. 92; vii, p. 286], are here translated into English, and those of Wilson and Miss Wilson on the occurrence of the trouble in England [ibid., vii, p. 289] are reprinted. Notices of these papers have already appeared in this *Review*.

PARDÉ (L.). **La régénération du Chêne rouge d'Amérique dans le domaine des Barres.** [The regeneration of the American red Oak in the Barres domain.]—*Rev. Eaux et Forêts*, lxvi, 9, pp. 567–570, 1928.

In connexion with a general statement on the advantages of the American red oak (*Quercus rubra*) and its variety *Q. rubra* var. *ambigua* for regeneration purposes in the Barres domain (south-east of France), attention is drawn to the resistance of this species to mildew [*Microsphaera quercina*: *R.A.M.*, vii, p. 206]. *Q. toza* and *Q. pedunculata* are highly susceptible to the disease in question, and their replacement by *Q. rubra* may well be considered in districts where the ravages are severe.

PASSALACQUA (T.). **Vaiolatura fogliare del Leccio (Quercus ilex) prodotta dalla 'Phyllosticta quercus-ilicis' (Sacc.).** [Leaf spot of Ilex (*Quercus ilex*) caused by *Phyllosticta quercus-ilicis* (Sacc.).]—*Curiamo le Piante!*, vi, 5, pp. 91–92, 1928.

The author observed the leaf spot due to *Phyllosticta quercus-ilicis* on ilex oaks at Alba. The disease is characterized by the presence on the upper surface of the leaves of isolated or sometimes confluent, irregular, silvery-white spots with a sharply defined margin, bounded by a narrow, brownish-red zone. These spots may become torn or perforated and the leaves turn yellow and generally fall. The spots are marked on the upper surfaces by small black pycnidia, containing spores measuring 4·5 by 3·5 to 4 μ.

Suggestions for the control of the disease are given.

GIODA (A.). **Si può vincere il male dell' inchiostro?** [Can ink disease be cured?]—*Il Coltivatore*, lxxiv, 25, pp. 198–203, 4 figs., 1928.

The author reports a case in which chestnut ink disease [*Phytophthora cambivora*: *R.A.M.*, vii, p. 549] has apparently been controlled by digging a small trench round the collar of affected trees, washing and drying out the diseased parts of the roots, and, in severe cases, removing the old branches, this practice invariably leading to the disappearance of the symptoms: young grafts so treated also reached maturity in perfect health.

Amid widespread and severe infection the treated trees showed marked vegetative vigour, with no necrosis of the roots, which, after the treatment, regained their normal vigour and numerous

adventitious ones developed. Trees so treated for five to seven years showed only old traces of infection.

PASINETTI (L.). **Suggerimenti terapeutici contro la batteriosi del Gelso.** [Therapeutical suggestions against bacterial blight of Mulberry.]—*Curiamo le Piante!*, vi, 1, pp. 2–6, 1 fig., 1928.

Bacterial blight of mulberry (*Bacillus cubonianus*) [*Bacterium mori*: *R.A.M.*, iv, p. 73] is exceptionally severe in Venetia, where not only are the tips of the twigs and the apical foliage affected, but the disease also spreads down the stem, producing a long, black, longitudinal line, at first covered by the epidermis, but later becoming a deep slit extending to the medulla and having an ulcerated appearance and necrosed edges. The affected part of the branch usually withers, though sometimes, especially when infection takes place immediately under the apex, the lesion may become cicatrized. The disease appears in May and is most severe on plants grafted the same spring.

In a very large nursery where infection had reached alarming proportions in spite of repeated applications of Bordeaux mixture, the spread of the disease from plant to plant as well as in the individual plants was quickly arrested by the preliminary removal of the necrosed parts and weekly applications of either 0·06 per cent. corrosive sublimate plus 1·5 per cent. slaked lime, or 0·2 per cent. potassium permanganate with 2 per cent. starch, from May until the weather ceased to favour infection.

The economic importance of the disease is indicated by the fact that the cutting off of the top of young plants which becomes necessary when they are infected reduced their value by about 25 per cent.

FERRARIS (T.). **A proposito della lotta contro la bacteriosi del Gelso.** [On the control of bacterial blight of Mulberry.]—*Curiamo le Piante!*, vi, 9, pp. 180–182, 1928.

Referring to Pasinetti's paper on bacterial blight of mulberry [see preceding abstract] and to a view expressed by Curzi (*Italia agricola*, 5, May, 1928) that whereas the pathogenicity of *Bacterium mori* Boyer & Lambert em. E. F. Smith has been established, *Bacillus cubonianus* Macchiati is only a secondary saprophyte, the author states that the specific agent of the disease was discovered by Cuboni and Garbini in 1890 [and named by Macchiati in 1892], whereas *Bact. mori* was named by Boyer and Lambert only in 1894. While agreeing that *B. cubonianus* may have been a secondary follower of *Bact. mori*, he points out that Peglion's inoculations with Macchiati's bacillus reproduced the disease, and expresses the opinion that the latter's cultures were probably mixtures of two organisms, one of which was the true pathogen, subsequently studied by Smith. By precedence, therefore, *Bact. mori* should be considered as a synonym of *B. cubonianus*, the name of which should be changed to *Bact. cubonianum* (nom. nov.) (= *B. cubonianus* Macch. pp.; *Bact. mori* (Boy. et Lamb.) E. F. Smith).

CAPPELLETTI (C.). **Massaria mori J. Miyake parassita del Gelso ed il suo ciclo evolutivo.** [*Massaria mori* J. Miyake, a parasite of Mulberry and its life-cycle.]—*Riv. Pat. Veg.*, xviii, 7–8, pp. 133–149, 1928.

In February, 1928, the author received from the Euganean hills young mulberry branches, the bark of which was softened and easily separable from the wood in large, irregularly oval, whitish patches, generally crossed by dark, reddish bands which became rugose as the branch withered. Infection was most severe at the tips of the branches, where the bark was split. The disease, which had destroyed a long row of the trees, was regarded as serious in that large areas of the branches became affected simultaneously.

On the affected bark the author found red sporodochia of a species of *Fusarium* with 3- to 4-septate, slightly curved conidia, 30 to 35 by 2·3 to 5 μ in diameter, which in culture also produced smaller spores with 1 to 3 septa and 12 μ in length. Pycnidia of a species of *Dendrophoma* and perithecia of *Massaria mori* Miyake were also found, all three organisms being sometimes present on the same branch.

In culture on potato the pycnidiospores of the *Dendrophoma* and fragments of the perithecia of *M. mori* both gave rise to *Fusarium* conidia, which were 3-septate and measured, respectively, 25 to 30 and 25 to 35 by 2·5 to 3 μ. One of the *Massaria* cultures also developed the characteristic *Dendrophoma* pycnidia with bacillary pycnospores, 3 to 5 by 2·5 μ in diameter. The cultural characters of all three fungi were similar, and all developed pseudoparenchymatous blue-walled bodies, which are regarded as immature pycnidia or perithecia. Hence all are regarded as stages of the one organism, the imperfect forms being named *F. moricolum* and *D. moricola*, respectively, and Latin diagnoses being given. *M. mori*, their perfect stage, was described on *Morus alba* in Japan in 1916 and was probably introduced into Europe from the Far East. Although closely resembling *Gibberella moricola*, with its imperfect form, *F. lateritium*, in its mode of attack and in the *Fusarium* stage, *M. mori* appears to be a more virulent parasite on mulberry than the former.

In Sydow's 'Mycotheca Germanica' the specimen, no. 1241, collected by P. Vogel in Brandenburg in 1913 and determined as *G. moricola*, consists of young mulberry branches bearing *D. moricola*, with a few sporodochia of *F. moricolum*.

MAGERSTEIN (V.). **Der Wurzeltöter als Korbweidenschädling.** [The root-killer as a pest of basket Willows.]—*Der Deutsche Korbweidenzüchter, 1928*, August–September, pp. 80–81, 1928.

Serious damage has been caused in the Mělnik (Czecho-Slovakia) American willow (*Salix americana*) plantations by the attacks of *Rhizoctonia violacea* [*R. crocorum*].

The roots of infected trees swell, soften, wilt, and eventually become rotten. The leaves lose their gloss and show a yellowish-green, later brownish-purple discoloration, accompanied by conspicuous drooping and curling of the surfaces: they may remain

on the trees for a considerable time after their death. The rods of affected trees attain only half or a third of the normal length and are too brittle for plaiting. The symptoms of the *Rhizoctonia* disease become apparent about the end of May; the discoloration of the leaves and wilting of the rods may be observed during the period of intensive growth (until the end of August), and the desiccation and ultimate death of the trees begins in September. Under suitable conditions for the development of the fungus (waterlogged soils with insufficient aeration) the disease may cause extremely heavy losses. The spread of infection may be arrested by suitable cultural measures, such as the destruction of diseased material, application of lime and manure to the soil, drainage, and soil disinfection.

Comments on this paper are made by Prof. Ludwigs and P. Kaiser.

CRUCHET (P.). **Relation entre le Caeoma de l'Arum maculatum et le Melampsora allii-populina.** [Relation between the *Caeoma* of *Arum maculatum* and *Melampsora allii-populina*.] —*Bull. Soc. Vaud. Sci. Nat.*, lvi, 221, pp. 485–487, 1928.

A brief description is given of the author's successful inoculation experiments near Lausanne with the teleutospores of *Melampsora allii-populina* from *Populus nigra* on *Arum maculatum*, *Allium ursinum*, *A. carinatum*, and *A. sphaerocephalum*. A *Caeoma* agreeing with *C. ari-italici* developed on the inoculated plants, thereby demonstrating the genetic connexion between these two fungi [cf. *R.A.M.*, vi, p. 756].

SPRAGUE (R.) & HEALD (F. D.). **A witches' broom of the Service Berry.**—*Trans. Amer. Microscop. Soc.*, xlvi, 4, pp. 219–238, 4 pl., 1927. [Received 1928.]

For some years past a sooty mould, apparently due to an imperfect fungus of the *Cladosporium* type, has been observed in connexion with a perennial witches' broom on service berry (*Amelanchier florida* and varieties) leaves near Pullman, Washington. It is also known to occur throughout the range of the host in the northern United States and Canada, and has been collected as far south as the Carolinas and New Mexico. The ascigerous stage of the fungus, usually known as *Dimerosporium collinsii* (Schw.) Thüm., but more correctly named *Apiosporina collinsii* (Schw.) von Höhn. [*R.A.M.*, v, p. 333], was only found at the close of the investigations, though its occasional local occurrence in the Palouse region is indicated by collections dating back to 1893.

In old-established infections the witches' brooms are of two types, viz., the typical compact, short, thickly branched, pendulous form, and the looser open type, the latter occurring in more exposed places. The leaves are small, narrow, yellowish, and covered on the under side with the dark olive sooty mould (except on the main veins). The leaves wither and fall in early summer, giving place in very old brooms to a second crop of very sickly foliage.

In young infections, before the witches' brooms form, the young twigs, though slender, appear normal. The leaves are somewhat reduced in size and are covered with the fungus. They sometimes

cling to the tree until the spring, and no second crop is produced. Later symptoms include a sharp angling of the branches, an increase in the number of twigs with swelling of the main one, thickening and shortening of the branches, and roughening of the bark. The perfect stage of the fungus begins to develop in mid or late summer. The witches' brooms are very long-lived, one of those observed producing infected leaves for nine years.

It is stated that previous workers have failed to demonstrate the internal and perennial nature of the fungus. The authors found a hyaline mycelium in the lamina and petioles of the leaves, in buds, and in the phelloderm region of infected twigs. Cross sections of leaves showed a stromatic superficial mycelial layer which was traceable through the guard cells into the leaf. The organism was readily discernible in carefully stained sections of the petiole and flower parts.

The simple or branched, free or clustered, pluri-cellular, dark olive-brown conidiophores, arising from a stromatic layer, measure 85 to 140 by 4 to 6 μ. The olive-brown, citron-shaped, ovate, or oblong, unicellular spores, measuring 8 to 17 by 6·1 to 8·2 μ (rarely up to 20 by 9 to 10 μ), are produced terminally and laterally in large numbers. The hyphae are variable, hyaline, septate, irregular, with prominent oil drops, and measure 2 to 10 μ in diameter (average 5 μ). They occupy the phelloderm region of the stem, where they dissolve the middle lamellae, spread the cells slightly apart, and appear to cause local disturbances in the cork cambium. The fungus can be traced from the leaf exterior into the mesophyll, down the petiole, and into the twigs as far back as six-year-old wood.

The perfect stage consists of small, globose, apparently ostiolate, slightly hairy perithecia, densely aggregated in the subiculum covering the lower leaf surface. The ascospores are bicellular and hyaline, with the lower cell much smaller than the upper.

The mode of dissemination is doubtful, but there is some indication that infection may take place through cracks in the forks of the twigs.

Von Höhnel's description of *Apiosporina* is revised to include the newly discovered facts regarding the internal nature of the organism. Association and a careful study of the formation of the subiculum have convinced the writers that the *Apiosporina* is genetically connected with the *Cladosporium* form.

NARASIMHAN (M. J.). **Note on the occurrence of intracellular bodies in spike disease of Sandal (Santalum album Linn.).** —*Phytopath.*, xviii, 9, pp. 815–817, 3 figs., 1928.

The main symptoms of spike disease of sandal (*Santalum album*) [*R.A.M.*, ii, p. 380], which causes an annual loss of about $150,000 in south India, are a reduction in the size of the leaves, curtailment of the internodes, phyllody of the flowers, and death of the root-ends and haustoria, leading to the death of the tree. The most striking feature is the accumulation of starch in the leaves and twigs [see next abstract].

A cytological investigation of the disease, conducted in 1927, revealed the presence of round or oval, vacuolate, intracellular

bodies in the cells of the spiked leaves, usually in close association with the nuclei. Generally only a single body is found in a cell, though two or three may occur. Indications of nuclear degeneration have been observed in some of the cells containing these structures, which stain readily with iron-alum haematoxylin or Flemming's triple stain. Similar bodies have been found in leaves of *Vinca rosea* affected by an analogous disease. This discovery is considered to lend support to Coleman's view that spike is one of the virus group of diseases.

IYENGAR (A. V. V.). **Contributions to the study of spike disease of Sandal (Santalum album Linn.). Part II. Analysis of leaves from healthy and spiked trees. Part III. Physico-chemical study of the leaf-sap.**—*Journ. Indian Inst. Sci.*, xi A, 9, pp. 97–109, 1 diag., 4 graphs, 1928.

In continuation of previous investigations on spike disease of sandal (*Santalum album*) [*R.A.M.*, vii. p. 550], the writer made a determination [by a method which is briefly described] of the comparative carbohydrate content, total nitrogen, and mineral matter in healthy and spiked leaves. The results of the analysis showed that diseased foliage contains more free reducing sugars, total carbohydrates, starch, total nitrogen, and dry matter than healthy leaves, the moisture content being lower. Spiked leaves were further found to be deficient in lime and potash. The ash content is higher in the healthy foliage.

The results of a physico-chemical examination of the leaf sap [the technique of which is described in detail] showed that in healthy sandal trees the hydrogen-ion concentration lies between P_H 5·15 and 5·71, while in spiked individuals from the same area the range was from P_H 4·69 to 4·99.

The titratable acidity of the spiked samples was shown to be greater than that of normal ones, and the osmotic concentration is also higher in the former.

The specific conductivity of the sap of spiked leaves was found to be lower than that of normal leaves. Moreover, the ratio of specific conductivity to the depression in the freezing-point is lower in diseased than in healthy material. The greater depression in the freezing-point of the sap of spiked leaves was shown to be due to an increased soluble matter content.

BOYCE (J. S.). **Lophodermium abietis on Pseudotsuga taxifolia.**—*Mycologia*, xx, 5, pp. 301–302, 1928.

Lophodermium abietis is stated to occur throughout the western United States on *Abies amabilis*, *A. concolor*, *A. lasiocarpa*, and *Picea sitchensis*, but Douglas firs (*Pseudotsuga taxifolia*) growing in the vicinity of infected stands appear to be immune. It is thought that the previous records of the occurrence of this fungus on Douglas fir, both in the United States and Denmark, are based on errors in host determination, the only United States specimens examined by the author proving to be on *A. lasiocarpa* though labelled *P. taxifolia*, while Lind's Danish material contained an admixture of spruce needles on which alone the fungus occurred.

DELEVOY (G.). **Chronique forestière. Bruyères et Armillaria mellea.** [Forestry notes. Heather and *Armillaria mellea.*]—*Bull. Soc. Centr. Forest. Belgique*, 35th year [xxxi], 9, pp. 359–360, 1928.

In 1927, young Scotch pines [*Pinus sylvestris*], with which part of a wood in the vicinity of Houthaelen, Belgium, had been replanted two or three years previously, were observed to be in poor condition, while large patches of 3- to 4-year-old heather (*Calluna vulgaris*) around them were dying. The roots of the latter were covered by a white mycelium, identified as that of *Armillaria mellea.* It is considered possible that infection was due to the rotting of pine stumps left in the soil after the original plantation had been destroyed by artillery fire in 1918.

SNELL (W. H.), HUTCHINSON (W. G.), & NEWTON (K. H. N.). **Temperature and moisture relations of Fomes roseus and Trametes subrosea.**—*Mycologia*, xx, 5, pp. 276–291, 1 pl., 2 graphs, 1928.

The writers describe the technique and results of their experiments in the identification of wood-destroying fungi by means of the temperature responses of the mycelium [cf. *R.A.M.*, ii, p. 148]. Of the closely related pairs of fungi used in the tests, *Lenzites sepiaria* and *Trametes protracta* made the best growth at approximately the same temperature, viz., between 30° and 34° C., but the upper limits for development were different—40° for *L. sepiaria* and 38° for *T. protracta.* The former also made much more rapid growth at all temperatures, especially from 28° to 36°. These data are considered to support the generally accepted view that *L. sepiaria* and *T. protracta* are distinct species. Similar evidence was obtained in the case of *Fomes roseus* and *T. subrosea* (cf. Weir, *Rhodora*, xxv, p. 214, 1923), the optimum temperature for the former being about 26° and that for the latter approximately 30°. *F. roseus* was also found to possess a lower moisture requirement than *T. subrosea.*

WALKER (J. C.) & WELLMAN (F. L.). **A survey of the resistance of subspecies of Brassica oleracea to yellows (Fusarium conglutinans).**—*Journ. Agric. Res.*, xxxvii, 4, pp. 233–241, 1 fig., 1928.

The writers describe and tabulate the results of a survey, conducted on infested soil in Wisconsin, of the reaction of subspecies of *Brassica oleracea* to yellows (*Fusarium conglutinans*) [*R.A.M.*, vii, p. 418].

Although most cabbage varieties commonly grown in America, e.g., Jersey Wakefield, Copenhagen Market, All Head Early, and Danish Ballhead, are highly susceptible to yellows, varying degrees of resistance were found among thirty foreign varieties seldom used in the United States. Thus, eleven of these varieties, including All Heart and Late Drumhead Savoy, are equally susceptible with the average American commercial variety; twelve are moderately resistant (e.g., Christmas Drumhead and Earliest of All), comparing favourably with Houser and Volga in the United

States; and seven, including Imperial, St. Denis, and Vaugirard d'Hiver, are highly resistant.

The European wild cabbage (*B. oleracea* var. *sylvestris*) proved highly resistant, only about a quarter of the selfed progenies from individual plants showing infection. Brussels sprouts (*B. oleracea* var. *gemmifera*) and broccoli (*B. oleracea* var. *botrytis*) were moderately susceptible, and cauliflower (*B. oleracea* var. *botrytis*) somewhat more so. The kale (*B. oleracea* var. *acephala*) varieties were found to differ widely in susceptibility, the Siberian being very resistant and the curled leaf types decidedly susceptible, while the smooth leaf strains and collards were intermediate. All the kohlrabi (*B. oleracea* var. *caulo-rapa*) varieties tested were very susceptible. All the groups used in these trials (even the last) contained a sufficient number of resistant individuals to encourage further experiments in their improvement by selection.

BROWN (NELLIE A.). **Bacterial pocket disease of the Sugar Beet.** —*Journ. Agric. Res.*, xxxvii, 3, pp. 155–168, 1 pl., 4 figs., 1928.

In 1923 there was a recurrence, at the Arlington Experiment Farm, Rosslyn, Virginia, of the so-called bacterial pocket disease of sugar beets, which was first described on material from Colorado and Kansas, and the causal organism named *Bacterium beticolum*, in the first Bulletin on crown gall published in 1911.

The disease is characterized by the occurrence of nodular outgrowths at the crown either singly, in groups, or coalesced. The individual nodules measure 1 to 3 cm. across by about 1 cm. in thickness. In many cases, however, the tumour assumes the localized, globose form characteristic of crown gall (*Bacterium tumefaciens*), from which it can only be differentiated by an examination of the tissues. In crown gall these are white and sound whereas bacterial pocket tissue is brown and excavated into cavities usually containing a mucilaginous substance. As pointed out by Potebnia the name should be changed from *Bact. beticolum* to *Bact. beticola* (cf. *Phytopath.*, vi, p. 293, 1916). Serbinow's *Bact. beticola* (*Boliezni Rastenie*, vii, p. 237, 1913) is considered to be a distinct organism.

A full description is given of the cultural and physiological characters of the bacterial pocket organism, together with an emended technical diagnosis in English. *Bact. beticola* is a short, motile, yellow rod, with one to four long polar flagella, measuring 0·6 to 2 by 0·4 to 0·8 μ; irregular round or oval forms, twice the normal size, were observed. The organism stains readily with gentian violet and carbol fuchsin, is Gram-variable, and non-acid-fast; it is aerobic; liquefies gelatine slowly; reduces nitrate and litmus; coagulates milk; forms acid from dextrose, saccharose, maltose, and mannite, but not lactose; makes good growth in Uschinsky's and Fermi's solutions but none in Cohn's; has an optimum temperature about 29°, a maximum of 39°, a minimum of 1·5° C., a thermal death-point of 51° to 52°, and a P_H range of of 4·8 to 9·1; it is resistant to desiccation and sunlight and maintains its viability for 14 months in sterile milk at 22° to 29°; the index number of the organism, based on the chart of the Society of American Bacteriologists, is 502 var. –31125 –1222.

PASSALACQUA (T.). **Germogliazione patologica delle Cipolle prodotta da Bacterium cepivorum (Delacr.) T. Pass. Nota preliminare.** [Pathological sprouting of Onions produced by *Bacterium cepivorum* (Delacr.) T. Pass. Preliminary note.]—*Curiamo le Piante!*, vi, 4, pp. 61–66, 3 figs., 1928.

Onions stored during winter in Italy showed a premature but vigorous sprouting which was arrested by the decay or softening of the bulb tissues. From infected material the author isolated *Bacterium cepivorum*, inoculations with which into healthy onions reproduced the condition. The organism is considered to be a wound parasite.

PORTER [D. R.]. **New Onion disease in Iowa.**—*Plant Disease Reporter*, xii, 8, p. 93, 1928.

A disease believed to be mosaic, characterized by the appearance of pronounced yellow streaks on the stems and leaves, has appeared in the Yellow Bottleneck onion fields of Pleasant Valley, Scott County, Iowa. Affected plants lose their turgor and collapse. The disease was transmitted by artificial inoculation into the growing point of the bulbs. A preliminary estimate places the loss from this cause at 25 per cent. Simultaneously with the above-mentioned outbreak the condition was observed at Washington, Iowa, on a farm where the onions have been grown from seed for a number of years.

FAES (H.). **Influence des conditions climatériques sur le développement des insectes et champignons parasites des cultures.** [Influence of climatic conditions on the development of insects and fungi parasitic on cultivated plants.]—*Annuaire Agric. de la Suisse*, xxix, 3, pp. 221–228, 1928.

Brief notes are given on the relation between seasonal meteorological conditions and the incidence of [downy] mildew (*Peronospora* [*Plasmopara*] *viticola*) and coître (*Coniothyrium diplodiella*) of the vine in Switzerland [*R.A.M.*, vii, p. 358].

SARTORIUS (O.). **Versuche mit Staubmitteln gegen Peronospora und Wurm 1927.** [Experiments with dusts against *Peronospora* and moth in 1927.]—*Deutscher Weinbau*, vii, 8, p. 89; 9, p. 99, 1928. [Abs. in *Fortschr. der Landw.*, iii, 22, pp. 1045–1046, 1928.]

An experiment was conducted on a large scale to test the comparative merits of some liquid and dry combined insecticides and fungicides in the control of vine downy mildew (*Peronospora*) [*Plasmopara viticola*] and moths [*Clysia ambiguella* and *Polychrosis botrana*]. Some of the plots were dusted seven times with cusisa-cusarsen, nosperit-nosprasit, and horst-vinuran, applied in increasing doses of 10 to 18 kg. per 24 are, while others were sprayed five times with nosperal-lead arsenate and nosprasen-Silesia green (400 to 500 l.) [cf. *R.A.M.*, viii, p. 85]. Little difference was observed between the sprayed plots and those dusted with cusisa-cusarsen or nosperit-nosprasit, though the young foliage was more severely infected in the latter: horst dust, however, gave less satisfactory results.

GABOTTO (L.). **Le segnalazioni antiperonosporiche.** [Antimildew warnings.]—*Curiamo le Piante!*, vi, 9, pp. 170–171, 1928.

Though arrangements were made in the interests of economy for some 18 responsible vine growers acting as forecasting stations [cf. *R.A.M.*, ii, p. 6] in the province of Alessandria to warn their neighbours when any impending attack of *Peronospora* [*Plasmopara viticola*] should necessitate preventive measures, yet in 1928, when owing to scanty rainfall and the fact that the conditions first became favourable for primary infection only between 29th and 31st May, adequate control was given by two or three applications of copper sulphate mixtures, other growers persisted in giving the 12 or 14 treatments recommended for very wet seasons, with a consequent waste of some 90 million lire.

RAVAZ (L.). **Chronique: Le mildiou tardif.** [Current events: late mildew.]—*Prog. Agric. et Vitic.*, xc, 40, pp. 318–319, 1928.

Late attacks of vine mildew [*Plasmopara viticola*] were reported from districts in France which had experienced damp, warm weather during August, 1928, and especially where such places were also near water. In dry weather the lesions remain superficially sterile, but form winter spores within the tissues. The appearance of these sterile lesions, usually arranged in a mosaic pattern, should be carefully noted, as the first outbreak of mildew in the following season is likely to be most severe where they are most numerous.

MARCHAL (P.) & FOËX (E.). **Rapport phytopathologique pour les années 1926–1927.** [Phytopathological report for the years 1926–1927.]—*Ann. des Épiphyties*, xiii, 6, pp. 383–454, 1927. [Received December, 1928.]

In this report notes are given on the distribution and severity of the chief diseases of crops in France during 1926 and 1927. The following records are of interest. The conidial stage of potato mildew, *Erysiphe cichoracearum* [*R.A.M.*, vi, p. 59], was observed on the Fin de Siècle, Early Rose, and Saucisse rouge varieties at Dijon in 1926. The wilt of potatoes associated with *Colletotrichum atramentarium* [ibid., v, p. 651] was scarcely found anywhere in 1927. Tobacco wildfire (*Bacterium tabacum*) [ibid., v, p. 651; vii, p. 548] was very prevalent during July, 1926, in the Bas-Rhin department, but owing to a dry summer did not spread subsequently. The disease was also present in 1927 on tobacco growing near Châtillon in a plain which was inundated in early spring. Downy mildew (*Pseudoperonospora humuli*) [ibid., viii, p. 61] was widespread on hops in 1926 in Alsace, Lorraine, and in the Côte d'Or region of Burgundy; in the last-named district severe losses were experienced from *Sphaerotheca humuli* early in the season, though checked later by drought. Fructifications of *Myxosporium corticola* [ibid., iii, p. 724; vi, p. 167] were observed in pears suffering from die-back in the Alps. *Podosphaera oxyacanthae* [ibid., v, p. 747; vii, p. 250] was reported on medlars (*Mespilus germanica*) at Dijon; this fungus was also prevalent on apricots,

especially on nursery stock, in the vicinity of Avignon, where it caused important losses during 1927. Almond branches affected with *Fusicoccum amygdali* [ibid., iii, p. 88; vi, p. 532] were received from Ardèche. The leaves of *Pinus maritima* near Mont-de-Marsan showed the presence of *Peridermium oblongisporium*, the aecidial stage of *Coleosporium senecionis*. Ink disease of the chestnut [*Phytophthora cambivora*: ibid., vii, p. 557] is slowly becoming more prevalent in France and Corsica, and the dying-off of elms [ibid., v, p. 334] is present over a great part of the country, including the south-west. [The latter is presumably the 'Dutch elm disease' due to *Graphium ulmi*, the presence of which in France does not, however, appear to have been definitely recorded.] Lilies (*Lilium candidum*) in the department of Var were attacked by *Cercosporella hungarica*. In June, 1927, flax in the plain of Caux (Seine-Inférieure) was slightly attacked by *Phoma exigua* Desmaz., *Colletotrichum lini*, and *Botrytis cinerea*.

At the conclusion of this report, on pp. 484–499, summaries are given of the work of the Phytopathological Stations in various parts of France, most of which has already been noticed from other sources. An organism closely resembling *Bacterium translucens* [ibid., v, p. 150] was found in wheat submitted to the Central Station in Paris, showing a black discoloration of the spikelets. Inoculations of *Nicotiana tabacum* and *N. sylvestris* at the same Station with *Bact. tabacum* isolated from diseased tobacco plants in the Bas-Rhin gave rise to the typical symptoms of wildfire.

GRAM (E.), JØRGENSEN (C. A.), & ROSTRUP (SOFIE). **Oversigt over sygdomme hos landbrugets og havebrugets kulturplanter i 1927.** [Survey of the diseases of agricultural and horticultural cultivated plants in 1927.]—*Tidsskr. for Planteavl*, xxxiv, 5, pp. 778–836, 1928.

This report is prepared on the usual lines [*R.A.M.*, vii, p. 222], except for the absence of an English summary. Among the numerous items of interest the following may be mentioned. Both stripe disease and net blotch of barley (*Pleospora graminea* and *P. teres*) are declining in intensity as a result of the widespread practice of seed treatment. Ergot (*Claviceps purpurea*) was equally prevalent on barley and rye, the most severe attacks occurring in Jutland on crops suffering simultaneously from bright speck (which was well controlled by the application of manganese sulphate at the rate of 50 kg. per hect.) or from yellow tip [reclamation disease: ibid., vii, p. 396]. Barley and wheat sustained exceptionally heavy damage from foot rot (*Fusarium culmorum*, *F. herbarum*, and *F. avenaceum*). Some indications for the control of this disease by cultural methods are given.

Kabatiella caulivora again caused heavy damage to [red] clover [*Trifolium pratense*], and lucerne in various localities suffered from a disease believed to be mosaic. *Aphanomyces euteiches* was isolated from the roots of peas affected by sudden wilting [ibid., vi, p. 388].

Beet mildew (*Peronospora schachtii*) appears to be gaining ground annually [cf. ibid., iii, p. 565 *et passim*], especially in fields of seed-bearers.

Soft rot (*Erwinia carotovora*) [*Bacillus carotovorus*] was extremely severe on turnips, which were also attacked by dry rot (*Phoma napobrassicae*) [*P. lingam*: ibid., vii, p. 70].

The potato harvest is described as the worst within living memory. Leaf roll was excessively prevalent and caused heavy reductions in yield, especially on the islands, where the Magnum Bonum variety is largely grown for table use. Mosaic and streak were also reported, the former mainly on early varieties. Wart disease (*Synchytrium endobioticum*) was discovered in a fresh locality near Ribe [close to the German frontier]. Late blight (*Phytophthora infestans*) occurred with almost unprecedented severity, the first outbreaks appearing at the beginning of July.

Cock's-foot grass [*Dactylis glomerata*] in the southern and eastern districts was attacked by a new and serious disease best described as foot rot. In the middle of July the panicles turned yellowish-brown and showed signs of premature ripening. The bases of the ears were brown, while the remnants of the surrounding leaves were in a semi-decayed condition and covered with *Fusarium* spp. The greyish-brown mycelium of an unidentified Pyrenomycete was also isolated from diseased material.

Reversion of black currants [ibid., vii, p. 700] was very prevalent round Kolding.

Outdoor tomatoes were extensively infected by late blight (*P. infestans*), which was admirably controlled by applications of Bordeaux or Burgundy mixture.

Hothouse cucumbers suffered from a peculiar disturbance characterized by a pale greenish-yellow discoloration of the intercostal areas and a water soaked, wilted appearance of the leaf edges. No parasitic organisms were found in the diseased plants, and it is thought that the condition may possibly have been due to excessive applications of fresh stable manure.

Brief notes are also given on the diseases of various ornamental plants and trees.

Trabajos de las Estaciones de Fitopatología Agricola. El servicio de consultas sobre plagas y enfermedades de las plantas cultivadas en el año 1927. [Work of the Stations of Agricultural Phytopathology. The advisory service in connexion with pests and diseases of cultivated plants in the year 1927.]—*Bol. Pat. Veg. y Ent. Agric.*, iii, 9–10, pp. 45–58, 1928.

Lists are given of the principal plant diseases observed at the Spanish Phytopathological Stations during 1927. Among other items of interest the following may be mentioned. Beets were attacked by *Microsphaera betae* in León, and by *Cercospora beticola* and *Phyllosticta betae* in Teruel. Mosaic of sugar-cane was observed at Adra (Almeria), where *Phytobacter lycopersicum* also occurred on pepper [*Capsicum annuum*] and tomato [*R.A.M.*, iv, p. 595]. The latter host was further infected by *Alternaria solani* in Corunna. Potatoes at Barcelona were attacked by *Bacillus* [*Bacterium*] *solanacearum* and *B. solaniperda* [*B. atrosepticus*]. Chestnuts in Lugo suffered from ink disease (*Blepharospora* [*Phytophthora*] *cambivora*).

WORMALD (H.). **Notes on plant diseases in 1926.**—*Ann. Rept. East Malling Res. Stat. 1926 and 1927, II Supplement*, pp. 75–88, 1928.

This paper contains the following items of phytopathological interest, apart from those noticed from other sources. During 1926, a conspicuous feature of spraying trials on apple trees at East Malling Research Station, Kent, was premature leaf-fall after applications containing sulphur, some shoots of Cox's Orange Pippin and Stirling Castle trees sprayed with lime-sulphur, 1 in 150, losing 30 to 50 per cent. of their leaves. *Botrytis cinerea*, favoured by wet weather, killed a number of flowering spurs of Morello cherries just before the flowers opened. The same fungus also killed a few young shoots of Victoria plums and caused a leaf blotch of red currants; the blotch was greyish, bordered by a dark line, and bore fructifications mostly on the lower side. Blotches were also caused by *B. cinerea* on the leaves of Canadian Wonder dwarf French beans [*Phaseolus vulgaris*]. Frequently the rot began where a fallen flower or petal had adhered to a leaf surface. Similar petal infections were observed on the leaves of various garden flowers. *B. cinerea* was also associated with a pod rot of runner beans [*P. multiflorus*], 'Mangetout' beans [*P. vulgaris*], and broad beans [*Vicia faba*], and was observed on garden peas, on the seeds of pods which had been attacked by insects. It also killed the leaves and shoots of lilac bushes [*Syringa vulgaris*] and very badly damaged a number of young lilac trees.

Plum rust (*Puccinia pruni-spinosae*) was unusually prevalent in 1926, the leaves on many trees, especially Victorias, turning yellow and falling prematurely. In the same year the aecidial stage of the rust was twice observed on *Anemone coronaria* [*R.A.M.*, iv, p. 420]. The stems of young mulberry trees in Hampshire, killed back by a canker, bore pustules of *Fusarium lateritium*, the conidial stage of *Gibberella moricola*. Gooseberry leaf spot (*Pseudopeziza ribis*) appeared early, and in Careless and Freedom bushes the leaves were badly spotted, turning yellow and falling by the middle of June; Whitesmith, White Lion, Greengage, and Gunner were less severely affected.

In August, 1926, 80 per cent. of the raspberry canes in a garden at Maidstone showed purplish patches, mostly at the nodes; during the winter, the diseased areas turned grey, then almost white, and bore black fructifications of *Didymella applanata* [ibid., vii, p. 615].

A wilt of hops was observed in Sussex, associated with a species of *Phoma* the conidia of which measured 4·5 to 9 by 2 to 4 μ. The fungus was isolated in pure culture but its parasitism was not ascertained. Wild hop leaves were found showing greyish spots bordered by a dark line and bearing the fructifications of a species of *Ascochyta*, the identity of which with *A. humuli* has not yet been established.

A wilt disease of rhubarb associated with a species of *Verticillium* was observed in a garden near Deal. Hawthorn leaf blotch (*Sclerotinia crataegi*) was observed for the first time in England on one leaf at Maidstone; the fungus is stated to be closely related to those reported as causing a similar disease on quince and medlar [*Mespilus*] leaves.

WORMALD (H.). **Notes on plant diseases in 1927.**—*Ann. Rept. East Malling Res. Stat. 1926 and 1927, II Supplement*, pp. 111–118, 1928.

This report contains many items of phytopathological interest, only some of which can be noticed here. Towards the end of May, 1927, many branches of Norfolk Beauty apple trees at East Malling were observed to have dead tips, the recently killed parts bearing flower trusses which had withered as the flowers opened. No organism was regularly found in the tissues, and it is suggested that the condition was a severe form of leaf scorch associated with potash deficiency [*R.A.M.*, vii, p. 728]. Stirling Castle apple trees which after being sprayed with lime-sulphur in 1925 and 1926 had suffered premature leaf fall, showed definite stunting in 1927. Sooty blotch, apparently identical with the condition caused by *Gloeodes pomigena* in America, was present on apples, especially on Bramley's Seedling, during the autumn.

A severe attack of leaf spot (*Pseudopeziza ribis*) occurred on Baldwin black currants in Kent. Defoliation took place before the fruit, which was small and somewhat shrivelled, was picked, and by the middle of September was almost complete throughout three acres of bushes, although other varieties in proximity to the Baldwins remained unaffected. The diseased bushes each yielded an average of one pound less than the healthy ones.

Two instances of rhubarb rot associated with a species of *Verticillium* were observed.

FAES (H.). **Station fédérale d'essais viticoles à Lausanne et Domaine de Pully. Rapport annuel—1927.** [Annual report for 1927 of the Federal Viticultural Experiment Station at Lausanne and Domaine de Pully.]—*Annuaire Agric. de la Suisse*, xxix, 4, pp. 455–480, 3 figs., 1928.

Among the various items of phytopathological interest in this report the following may be mentioned. The viability of the pycnidia and spores of the causal organism of coître (*Coniothyrium diplodiella*) [see above, p. 149] has now been maintained in the laboratory for seven years.

Excellent control of shot hole of cherries (*Clasterosporium carpophilum*) [*R.A.M.*, vii, p. 730] was given by the application of 1 per cent. copper sulphate mixtures to the lower part of the crown of the trees after flowering. Lime-sulphur proved less satisfactory owing to the readiness with which it was washed off by the heavy rain.

Biology.—*Ann. Rept. Dept. of Agric. New South Wales for the year ended 30th June, 1927*, pp. 18–19, 1928.

The following items of phytopathological interest occur in this report. Downy mildew (*Sclerospora macrospora*) was recorded on three new hosts, viz., barley, rye, and black oats [*Avena nigra*]. Leaf scald of barley (*Rhynchosporium secalis*) was prevalent in various parts of the State. Cob and stalk rot of maize, associated with *Fusarium moniliforme* [*Gibberella moniliformis*], *G. saubinetii*, and *Diplodia zeae*, was also widespread.

Anthnacnose of lettuce (*Marssonina panattoniana*) [*R.A.M.*, iii,

pp. 9, 314] was reported, for the first time in New South Wales, from the Goulburn district.

Good results in the control of citrus scab (*Sporotrichum citri*) were obtained by spraying with Bordeaux mixture (6–4–100) plus 1 per cent. red oil just after the main crop blossoms had set in the spring.

The application of sulphur to the soil was found materially to reduce the incidence of crown gall (*Bacterium tumefaciens*).

In the Tobacco Expert's report (p. 18) it is stated that blue mould of seedling tobacco [*Peronospora hyoscyami*: ibid., ii, p. 354] was absolutely controlled by maintaining the temperature in the frames at 45° F.

EASTHAM (J. W.). **Report of Provincial Plant Pathologist, Vancouver.**—*Twenty-second Ann. Rept. Dept. of Agric. British Columbia for the year 1927*, pp. Q 34–Q 37, 1928.

Witches' broom of potato [*R.A.M.*, vii, p. 663] occurs chiefly in the northernmost potato-growing area, i.e., in the Canadian National Railway Belt. A plant grown on an experimental plot at Agassiz in 1926 had about 100 shoots and produced some 100 tubers, many above ground and none larger than a fair-sized filbert. The plants from the six largest and soundest of these tubers were extremely small and weak, reaching a height of only 3 inches. By the end of August they had died down completely, and produced no tubers. Probably, therefore, this disease is to some extent limited by the dying-out of affected plants, though these may serve as infection centres in the presence of the proper vectors.

The progeny of potato plants affected by streak developed marked symptoms of mosaic, indicating that these two diseases may be considered as identical for field inspection and certification purposes [cf. ibid., vii, p. 260].

Full details are given of a series of experiments in the control of the *Rhizoctonia* disease of potatoes (*Corticium*) [*solani*] by various methods of seed disinfection, and the results are also tabulated in an appendix on pp. Q 109–110. The most satisfactory compound tested was dust No. 37 bel [ibid., vii, p. 263], which resulted in an increased yield of 50 to 70 per cent. as compared with corrosive sublimate.

Tulip fire (*Botrytis tulipae*) [ibid., viii, p. 40] was very severe owing to the cold, wet spring. The incidence of infection may be reduced by the rejection of diseased bulbs for planting, stripping off and destroying the outer scales before planting, and rotation. The application of lime to the soil is also reported to have given good results.

Sclerotinia sclerotiorum attacked cucumber vines high above ground level, and was also observed on Jerusalem artichokes [*Helianthus tuberosus*] at Victoria and Nanaimo [cf. ibid., vii, pp. 5, 362].

Heavy losses occurred among the Kootenay apple crops on account of scab [*Venturia inaequalis*: ibid., vii, p. 302]. In many cases the McIntosh and other susceptible varieties showed no sign of the disease until after the fruit was packed, when 200 to 300 pin-head spots developed on each apple. This condition had not been observed during the previous twelve years.

Robertson (W. H.). **Report of Provincial Horticulturist and Inspector of Fruit Pests.**—*Twenty-second Ann. Rept. Dept. of Agric. British Columbia for the year 1927*, pp. Q 18–Q 28, 2 pl., 1928.

This report contains the following items of phytopathological interest. The municipal authorities are now authorized to enforce spraying against plant diseases in districts where such a measure is considered advisable. This enactment has been attended by most satisfactory results.

The use of Bordeaux mixture for the control of cherry blossom blight (*Monilia* [*Sclerotinia*] *oregonensis*) [probably *S. cinerea*: *R.A.M.*, vii, p. 32] has not proved effective during three years' trials.

The best control of apple scab (*Venturia inaequalis*) [see preceding abstract] was given by three applications of liquid lime-sulphur (1 in 30 for the pink, and 1 in 35 for the calyx spray and that three weeks later).

Of the 14,191 acres inspected for fireblight [of apple] (*Bacillus amylovorus*), 10,833 were passed as free from infection.

Hector (G. P.). **Annual Report of the 1st Economic Botanist, Bengal, for the year 1926–27.**—*Ann. Rept. Dept. of Agric. Bengal for the year 1926–27, Appendix* I, pp. 35–38, 1927. [Received 1928.]

The following references are of interest in the mycological section of this report. Further investigations on a disease of betel vines [*Piper betle*] showed that two organisms are involved, viz., *Rhizoctonia destruens* [*Sclerotium rolfsii*] and a species of *Phytophthora* [cf. *R.A.M.*, vii, p. 539].

Damping-off (*Pythium de Baryanum*) on tobacco seed-beds was controlled by spraying with formalin (1 fluid ounce in 2 galls. of water).

Fusarium cubense was isolated from diseased bananas in Burdwan and Nadia. The Amritsagar, Chinichampa, Kabuli (dwarf), and Agniswar varieties are reported to be resistant to the disease.

Mulberry rust (*Aecidium mori*) was again prevalent at Constantia Nursery, Kurseong [ibid., vii, p. 304].

Campbell (J. G. C.). **Report by Government Mycologist.**—*Ann. Rept. Dept. of Agric. Fiji for the year 1927*, pp. 6–7, 1928.

A chromogenic bacillus, differing in cultural characters from *B*[*acterium*] *malvacearum*, was isolated from cotton bolls showing a yellow to light brown discoloration of the lint at its base, i.e., where it originated from the seed-coat.

A detailed microscopical and cultural examination of a number of coco-nut trees infected by bud rot on Taveuni yielded no evidence of the presence of *Phytophthora*, the predominant organism associated with the condition being *Thielaviopsis* [*paradoxa*: *R.A.M.*, vii, p. 629]. The annual loss from bud rot in the area under observation was estimated at only 0·3 per cent.

GARDNER (M. W.). **Indiana plant diseases, 1926.**—*Proc. Indiana Acad. Sci.*, xxxvii (*1927*), pp. 411-426, 8 figs., 1 graph, 1928. [Received January, 1929.]

Among other items of interest in this, the eighth of a series of annual summaries of the plant disease situation in Indiana [*R.A.M.*, vii, p. 17], the following may be mentioned. An extremely destructive epidemic of fireblight (*Bacillus amylovorus*) occurred in the south-west of the State on the Jonathan, Transparent, and Willow apple varieties. In many cases the half-grown Transparent fruit was invaded, usually by way of the pedicel but occasionally through wounds, from blighted blossoms in the same cluster, and showed a marked water soaking of the tissues, with large, sticky drops of bacterial exudate on the skin. Laboratory tests on mature Baldwin and Rome fruits showed that the organism progresses very rapidly through the vascular system of the fruit without causing any discoloration except a faint browning of the veins. On young Oldenburg trees many half-grown fruits were shrivelled, stunted, and often prematurely coloured owing to infection by spur cankers. Notes are given on the relative resistance to fireblight of different varieties, nine of which, including Gano, Arkansas, and Red Astrachan, appeared to be immune. Quinces were also attacked by *B. amylovorus.* Bitter pit was prevalent on King David apples, while Delicious, Winesap, and Grimes were attacked by measles or brown bark spot [ibid., vii, p. 228].

Discharging apothecia of *Sclerotinia fructicola* [ibid., vii, p. 32] were found under seedling peaches in Knox County. Heavy rains in August favoured the development of the brown rot caused by this fungus, especially on late varieties, e. g., Redbird.

Bacterial spot of tomatoes (*Bact. vesicatorium*) [see above, p. 140] was more prevalent than in any season since 1919. The peduncles, pedicels, and calyces were infected in addition to the foliage. The circular, whitish, 'bird's eye' type of fruit lesion was very general. Some degree of control was given by dusting with copper-lime. Heavy damage to the tomato canning crop was caused by buckeye rot (*P. terrestris*) [*P. parasitica*: loc. cit.].

Maize was attacked by *Aplanobacter stewarti* [ibid., viii, p. 98], and losses of 6, 3·5, 0·5, and 0·5 per cent., respectively, were reported for the *Gibberella* and *Fusarium* root and stalk rots [*G. saubinetii* and *G. moniliformis*], *Diplodia* [*zeae*], *Ustilago zeae*, and *Puccinia sorghi* [*P. maydis*].

Aster yellows [ibid., vii, p. 446] caused serious damage in Marion County. *Digitalis* (Giant Shirley) was infected by mosaic. White pine [*Pinus strobus*] needles and twigs were attacked by snow mould (*Scorias spongiosa*).

Annual Report of the Iowa Agricultural Experiment Station for fiscal year ending June 30, 1927.—63 pp., 1927. [Received 1928.]

The following items of phytopathological interest occur in this report. Further improvements have been effected in the Iacope strain of Copenhagen Market cabbage, which is resistant to yellows [*Fusarium conglutinans*: see above, p. 147]. Supplies of this strain are now available from seedsmen.

It was found that the best method of combining lime-sulphur and lead arsenate is to add the lead arsenate solution to a dilute solution of lime-sulphur in agitation. The addition of small amounts of hydrated high-calcium lime to a lime-sulphur-lead arsenate spraying mixture is more satisfactory than the admixture of lime of high magnesium content in preventing the precipitation of sulphur-lead compounds.

Coal tar and asphaltum paints have been found superior to lead paints in the control of blister canker of apples [*Nummularia discreta*: ibid., vii, p. 176].

BURGER (O. F.). **Report of Plant Pathologist.**—*Rept. Florida Agric. Exper. Stat. for the fiscal year ending June 30, 1927*, pp. 62R–77R, [? 1927. Received December, 1928.]

In addition to other items of interest in this report the following may be mentioned. Further investigations on scaly bark of citrus [usually attributed to *Cladosporium herbarum* var. *citricolum*] on the east coast of Florida and in the original centre of infection near Tampa have corroborated previous data on the time of appearance of the new infections, the age of the material on which these first appear, and their subsequent development [*R.A.M.*, vi, p. 401]. Inoculation experiments in which pieces of diseased material were used as inoculum gave negative results. Several strains of bacteria were consistently obtained in isolation studies, but no infections resulted from the inoculation of seedling trees with them in the greenhouse.

In connexion with the destruction of the citrus aphid (*Aphis spiraecola*) by the fungus *Empusa fresenii* [ibid., v, p. 552], it seems evident that the migration of the insects is responsible for the spread of the disease caused by this organism over long distances. New colonies examined during the latter part of March generally contained one or two diseased winged females. In no case was evidence obtained of the transmission of the spores by wind. The common vegetable aphid (*Myzus persicae*) does not appear to be susceptible to infection by *E. fresenii*.

Citrus trees suffering from chronic wilt or blight [ibid., vi, p. 401] fail to put out new growth at the normal time in spring. A weak flush of growth may or may not develop six or eight weeks later. Trees budded or grafted with budwood from various blighted trees are continuing to make good growth after three years.

Experiments have been started in the scraping and painting with antiseptics of psorosis lesions on citrus trees [ibid., v, p. 297] with a view to controlling this serious bark disease on grapefruit, orange, and tangerine trees, which is stated to be more widespread and of greater economic importance in Florida than gummosis.

Bud rot of coco-nuts was only reported from a very few new properties [ibid., vi, p. 401]. The various strains of *Phytophthora* isolated from rotted palms were found to differ somewhat in their morphological and physiological characters. Inoculation experiments with these organisms produced the typical symptoms of bud rot, which is considered to be due to a composite species [*P. palmi-*

vora], the various strains of which are not sufficiently distinctive to be raised to specific rank.

The potato crop was attacked with exceptional severity by late blight (*Phytophthora infestans*), and southern brown rot (*Bacillus* [*Bacterium*] *solanacearum*). Spindle tuber potato stock, selected in Maine, was planted in Florida and compared with healthy stock of the same strain, the relative yields being in the ratio of 35 to 83.

The source of primary infection in tomato mosaic in Florida has not yet been detected. None of the wild hosts examined appears to be of any great importance in this respect. It has been shown that the virus may exist for some weeks in the soil. Encouraging results were given by the early roguing of all mosaic plants, combined with the use of nicotine dust to reduce the dissemination of the disease by insects.

Strawberry runners were attacked on the stems by anthracnose due to a species of *Colletotrichum*. The light brown, oval spots later turned black and rapidly increased in size till they girdled the runners and extended for three or four centimetres lengthwise. Inoculation of young runners with the fungus resulted in the speedy development of infection, but similar tests on young leaves and petioles were unsuccessful.

Strawberry roots from diseased plants showing root knots resembling those due to nematodes, but in which the latter could not be detected, consistently yielded a species of *Fusarium* [ibid., vii, p. 727].

RIKER (A. J.), BANFIELD (W. M.), WRIGHT (W. H.), & KEITT (G.W.). **The relation of certain bacteria to the development of roots.** —*Science*, N.S., lxviii, 1763, pp. 357–359, 1928.

In continuation of Riker's and Keitt's studies of crown gall and wound overgrowth on apple nursery stock [*R.A.M.*, vi, p. 150], the writers carried out a series of inoculation experiments on one- to two-year-old grafted Wealthy apples with numerous strains of bacteria, closely resembling *Bacterium tumefaciens*, isolated from certain malformations on the underground parts of grafted apple nursery trees. At the end of the growing season no typical crown gall or hairy root was observed, but in certain cases small enlargements or sparse root developments occurred at the points of inoculation. Similar results were obtained in subsequent experiments with fifteen distinct strains of bacteria of the *Bact. tumefaciens* type. The enlargements occurring at the bases of these excessive root developments yielded apparently typical cultures of the strain used in the inoculation. Similar inoculations with cultures of highly pathogenic *Bact. tumefaciens* invariably led to the development of crown gall, but in no case was there any evidence of root stimulation.

Five of the root-stimulating cultures isolated from apple were inoculated into the underground parts of young honeysuckle (*Lonicera morrowii*) and rose (*Rosa setigera*) shoots. On both plants each of these strains gave a marked stimulus to root development. In all these experiments control punctures, without organisms, gave negative results.

Bacteriological studies are in progress to determine the relations between these root-stimulating organisms, various soil bacteria, and *Bact. tumefaciens* from crown gall on apple. Preliminary data indicate that certain important physiological and pathogenic differences, probably of specific rank, exist between *Bact. tumefaciens* and the root-stimulating organisms.

Discussion on witch broom disease.—*Proc. Agric. Soc. Trinidad and Tobago*, xxviii, 9, pp. 381-390, 1928.

A discussion took place at the general meeting of the Trinidad Agricultural Society on 13th September, 1928, as to the adoption of measures against the witches' broom disease of cacao [*Marasmius perniciosus*: *R.A.M.*, vi, pp. 603, 660], the occurrence of which in Trinidad was first observed near the L'Ebranche River towards the end of May. Subsequently it was noticed in other districts, e.g., Tamana. The disease was proclaimed and thereby became a matter for Government control under the Plant Protection Ordinance. Its identity was definitely established by Dr. Stahel, as a result of his inspection of affected material, and his recommendations for its control have been adopted. Since the inception of the eradication work in June a marked decrease in the incidence of infection has been reported. In co-operation with the Chamber of Commerce, the Agricultural Society passed a resolution for the formation of a Cacao Plantation Witches' Broom Inspection Committee for the purpose of ascertaining and recording the extent of the disease in the Colony.

STELL (F.). **Witch-broom disease of Cacao and its control.**—*Bull. Dept. of Agric. Trinidad & Tobago*, xxi, 3, pp. 3–14, 7 figs., 1928.

A semi-popular account is given of the witches' broom disease of cacao caused by *Marasmius perniciosus* [see preceding abstract], with notes on the conditions of climate and soil in the affected areas in Trinidad. The author has made an extensive series of cultures of, and inoculations with, *M. perniciosus*. Fourteen out of 40 seedlings inoculated by crushing the sporophores between the stipules of the buds developed the disease and the fungus was re-isolated. The organism was successfully isolated from pods, pod stalks, and cushions, and the fungus has been observed to fructify in nature on these organs.

The origin of the recent outbreak in Trinidad is obscure, as there is no evidence to indicate that it was brought from the mainland, where it has been known for many years. The wild *Theobroma speciosum*, which is heavily infected in Surinam, has not hitherto been reported in Trinidad.

The control measures suggested include the reduction of shade, which in many places is considered to be excessive; pruning not only to remove all diseased parts of the trees but to promote better ventilation; drainage of the low-lying, flat land on which most of the diseased trees are growing; and direct measures to destroy all diseased material by eradication and to protect the healthy trees by spraying.

The disease, which is believed (judging from the extent of the

infection) to have been present in Trinidad for some years, is thought to be susceptible to adequate control, since the conditions under which cacao is grown in the island are thought to justify a more hopeful outlook than might be expected from the experience in Ecuador and Surinam on the mainland.

In a note on this paper [on p. 13] A. B. Carr gives details of the control measures adopted in Surinam.

FREEMAN (W. G.). **Witch broom in Trinidad.**—*Trop. Agriculture*, v, 11, pp. 287–288, 1 fig., 1928.

This is a popular account of the witches' broom disease of cacao (*Marasmius perniciosus*) [see preceding abstracts] in Trinidad, where it is mainly confined to two areas about five miles apart, in very low-lying land on either side of the Central Range Forest reserve, in the north-east of the island, with a rainfall of some 100 to 120 inches. The incidence of the disease is most marked in the immediate neighbourhood of the rivers and streams with which the district is well supplied. Although, even in the worst portions, the attack is mild in comparison to the damage done in other tropical countries, active steps have been taken by the Trinidad Government to control and eradicate the disease, mainly consisting of a careful survey of all properties and the removal and destruction of all diseased growths from the cacao trees before they bear sporophores. Inspections should be made every two or three weeks, and attention should also be given to general sanitation, drainage, and shade in the plantations.

DUCOMET (V.) & FOËX (E.). **De l'appréciation de l'intensité des rouilles du Blé.** [On the evaluation of the intensity of attack of Wheat rusts.]—Reprinted from *Bull. Assoc. Internat. Sélectionneurs de Plantes de Grande Cult.*, Gembloux, i, 3, 22 pp., 1928.

The method for the evaluation of the intensity of infection of wheat with rusts (*Puccinia glumarum*, *P. triticina*, and *P. graminis*) described in detail in this paper was devised mainly to facilitate the task of breeders in judging the relative susceptibility to rust of varieties and pure lines of wheat under given environmental conditions [cf. *R.A.M.*, v, p. 350; vii, p. 770]. In order to obviate the influence of certain external factors (such as the vicinity of perennial alternate hosts, dates of sowing, variations in the constitution of the soil, manuring, and tillage) all the varieties to be tested are sown at the same time on one plot in six rows of each, alternating two by two with a row of a standard variety of known susceptibility.

For each variety careful note should be made of the dates when the plants reach the following stages of growth: swelling, i. e., when the young spikes can be felt inside the sheath of the second internode; the beginning of earing, i. e., when about ten spikelets are seen in two rows; end of the flowering period, when all the stamens are out; and the milky maturation stage of the grain. Observations of the appearance of the first symptoms of the rusts and of the further stages of their development should be made as frequently as circumstances allow and should be correlated with

the above-mentioned dates. Since the trials are usually continued for periods of not less than three consecutive years, it is thought advisable to note the intensity of attack by the fungi on the various organs of the wheat in absolute values obtained by the use of a numerical scale from 0 to 4 (the figures of which are obtained from the surface area of the individual organ visibly affected by the rust and not only from that bearing pustules), 0 meaning absence of any visible lesions, 1 that 1/10 to 1/4, 2 that 1/4 to 1/2, 3 that 1/2 to 3/4, and 4 that 3/4 and over of the surface is involved. These marks are then multiplied by a coefficient assigned to each organ considered according to its relative importance in regard to the production of the grain. Thus, for the leaves the coefficients are: 4 for the top leaf, 3 for the second from the top, 2 for the third, and 1 for the fourth (and fifth, if present). For the sheaths, the corresponding coefficients are 3 to 1; for the stem, 3 for the top and 1 for the next internode; and for the spikes, 3 for the rachis and 2 for the glumes. In regard to the grain, the intensity of attack is measured directly by the percentage of rusted grains in the ear at the moment of milky maturity. A method is also indicated by means of which the marks obtained for the various organs can be easily transformed into percentage notation by the use of division or multiplication factors, thus allowing the preparation of curves representing the progress of the disease during the whole vegetative period. These curves can then be compared with meteorological charts for the locality, and conclusions may be drawn as to the bearing of the climatic factors on the development of the rusts.

The complexity of the question of the reduction in yield caused by rust is considerably increased by the fact that wheats are seldom attacked by one species alone, and that the effects of the different species, either following each other or co-existing at the same time, are cumulative. It is only in years when one species alone is present, or when early sown varieties escape infection with *P. glumarum*, and late varieties are not infected with *P. graminis*, that a more or less correct evaluation can be arrived at in regard to the relative importance of each species. With *P. glumarum*, which is easily detectable at harvest time, it is comparatively easy to select a number of uninfected plants amid rusted ones after maturity, and by comparing the yield of both a very close approximation may be reached of the losses caused by this species. With *P. graminis*, however, the symptoms of which are entirely obliterated towards the end of the vegetative period, it will be necessary to mark out plants in the fields which escaped infection, or to control infection of a number of plants from the early stages onwards by spraying with fungicides [ibid., vii, p. 367], in order to be able at maturity to judge the reduction of yield caused by the disease.

SIBILIA (C.). **Ricerche sulle ruggini dei cereali.** [Researches on cereal rusts.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 3, pp. 235–247, 1 fig., 1928.

Germination experiments [details of which are given] with *Puccinia triticina*, *P. graminis*, *P. glumarum*, *P. coronifera* [*P. lolii*]

f. *avenae*, and *P. simplex* showed that exposure to temperatures between 35° and 37° C. reduced the germination capacity of the uredospores of all the species and completely inhibited that of *P. graminis* and *P. glumarum*. Germination did not take place when the uredospores were kept in darkness. The uredospores of *P. triticina*, *P. graminis*, and *P. simplex* retained their germination capacity for about one month, 20 to 22, and 30 to 32 days, respectively. In all cases, exposure of the uredospores to air containing 2 to 4 per cent. carbon dioxide favoured germination.

Tests conducted to ascertain the effects of carbohydrate nutrition upon the susceptibility of wheat to *P. triticina* [*R.A.M.*, i, p. 121; vii, p. 82] showed that after the plants had been screened from the light for some days, inoculations with *P. triticina* gave negative results. Plants kept in a very subdued light showed only very slight traces of infection eight or nine days after inoculation, though the controls in normal light showed clearly-marked pustules after five days. The incubation period was also prolonged by about two days by placing four-day-old plants in an atmosphere containing one per cent. carbon dioxide for 48 hours, then inoculating with *P. triticina*, replacing for 24 hours, and then exposing to normal air. Atmospheres with a moisture content above a certain point reduced the degree of infection.

MENCACCI (M.). **Sopra alcuni tentativi di lotta contro il 'mal del piede' del Frumento.** [On some attempts at the control of foot rot of Wheat.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 3, pp. 312–332, 1928.

During 1926–7 and 1927–8 experiments [which are described and the results of which are tabulated] were conducted near Rome to ascertain the effect of chemical sterilization of the soil upon the control of foot rot of wheat [*Ophiobolus graminis*, *Leptosphaeria herpotrichoides*, and *Fusarium* spp.: *R.A.M.*, v, p. 662; vi, p. 343]. In the former season Caffaro powder, copper sulphate (both at 100 to 150 kg. per hect.), Caffaro arsenate (Caffaro powder and lead arsenate: 75 kg. per hect.), and calcium cyanamide (300 kg. per hect.), while they all reduced infection also reduced the yield, as compared with the untreated plots. No very evident attack of foot rot occurred, however, in any of the plots in this season.

In 1927–8, further tests showed that Caffaro powder, copper sulphate, and sulphur, at the rate of 50 kg. per hect., again reduced the yield (except copper sulphate on one plot), in spite of the smaller quantities used than in the previous year; foot rot infection was, however, less severe in the treated than in the untreated plots.

Gentil Rosso 48 and Rieti 11 were more severely attacked than Mentana and Ardito wheat, the two former being late varieties, and, therefore, more susceptible to attack during the spring; the treatments given had much less effect in controlling the disease on these late varieties than on the earlier ones.

The author suggests that soil treatment with copper sulphate may prove beneficial in soils much infected with foot rot organisms or where other serious diseases prevail, since its fungicidal efficacy

may more than counterbalance its adverse effect upon germination; the treatment should be applied in autumn to prevent ascospore infection.

RIVERA (V.). **Osservazioni sopra la recettività di alcune varietà di Frumento per la Septoria graminum Desm.** [Observations on the susceptibility of certain Wheat varieties to *Septoria graminum* Desm.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 3, pp. 248–257, 1928.

Early in 1928, wheat growing on the plains in the vicinity of Perugia was attacked by *Septoria graminum*, the attack developing with unprecedented severity after a very cold snap about 22nd May. The disease was evidently favoured by unusual humidity in April, and still more so in May, since neighbouring areas with less heavy rainfall and drier soils showed much less infection. The early Ardito wheat was severely affected before the sudden drop in the temperature, and in general the attacks tended to coincide with the flowering times of the different varieties, some of which appeared to be naturally resistant to the disease. *S. graminum* is thought to be capable of attacking the host at any stage of development, but to be favoured by wet weather at about the flowering time of the wheat.

Observations made in experimental plots on the plains, where 32 different varieties were being grown, showed that in May infection was already well marked on about one-third of the varieties, especially the early-flowering ones, and in particular on Ardito; in June, the only variety which remained comparatively unaffected was Civitella 65 Avanzi, and as the leaves of this variety are remarkably tomentose, whereas those of many of the most susceptible varieties are almost hairless, its resistance is attributed largely to this anatomical feature.

NISIKADO (Y.) **Preliminary notes on a new helminthosporiose of Wheat (Triticum vulgare Vill.).**—*Ann. Phytopath. Soc. Japan*, ii, 2, pp. 89–98, 2 pl., 1928. [Japanese, with English summary.]

The leaves and leaf sheaths of wheat at Kurashiki, Okayama (Japan), were observed, in May, 1923, 1924, and 1927, to be covered with fusiform, yellowish-brown (later darker) spots, measuring 5 to 10 by 2 to 4 mm., and characterized by irregularly concentric zones and yellowish haloes. The affected leaves died prematurely from the tip downwards.

The causal organism was determined as a new species of *Helminthosporium*, *H. tritici-vulgaris*, a diagnosis of which is given in English. The simple, erect, dark olive conidiophores arise singly or in pairs from the infected tissues; they measure 90 to 400 by 6 to 8 μ (average $238{\cdot}9 \pm 5{\cdot}6$ μ in length) and have 1 to 13 septa (average $7{\cdot}08 \pm 0{\cdot}15$). The yellowish-brown, thin-walled, cylindrical conidia, which are usually straight or with a slight unilateral curve, measure 28·5 to 183 by 8·9 to 21·9 μ (average $118{\cdot}64 \pm 1{\cdot}19$ by $17{\cdot}39 \pm 0{\cdot}09$ μ) and have 0 to 10 septa (average $5{\cdot}03 \pm 0{\cdot}07$) at which there is little or no constriction. The basal cell protrudes

to a rounded conical end. Germination takes place from the polar as well as the intermediate cells.

The pathogenicity of the fungus was demonstrated by successful inoculation experiments on wheat leaves.

RIVERA (GIULIA & V.). **Sopra un ingiallimento patologico di foglie di Frumento nel 1928 a Perugia.** [On a pathological yellowing of Wheat leaves in 1928 at Perugia.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 3, pp. 300–312, 2 figs., 1928.

In February, 1928, Fabrini wheat growing under glass in the vicinity of Perugia showed a mosaic-like spotting of the young leaves; the plants recovered after a warm period in April, but with the return of cold weather in May large yellow patches appeared at the tips of the young leaves of the same and other varieties and spread towards the base. At the same time a rather different form of the condition appeared on wheat growing outdoors, in which a clearly marked horizontal line separated the affected area at the tip from the healthy base of the leaf. In severe attacks this line sometimes became a definite cut, the discoloured portion hanging almost vertically down, and the affected and healthy parts being connected only by the fibro-vascular tissue. Sometimes three or four such lines were seen, the leaf appearing to be disarticulated at several points. In other cases only the edge or middle of the leaf showed an elongated discoloured band, the affected part later becoming completely detached.

The condition remained quiescent in warm, sunny weather, but generally became worse after cold and rain. Its cause remains obscure. In the yellowed tissues the chloroplasts were found to be destroyed, probably from a deficiency in some substance, such as organic nitrogen, necessary for their nutrition. No other abnormal features were observed in the affected plants, and both forms of the disease are provisionally attributed to faulty nutrition.

GESCHELE (E.). Отношение Ячменей к паразитному грибку **Helminthosporium teres Sacc.** [The response of Barleys to the parasitic fungus *Helminthosporium teres* Sacc.]—*Труды по Прикладной Ботанике, Генетике и Селекции* [*Bull. Applied Botany, Genetics and Plant-Breeding*], xix, 1, pp. 371–384, 1 fig., 1928. [Russian, with English summary.]

This is the full paper on the reaction of 350 pure lines, 20 varieties, and over 100 hybrids of barley to infection by *Helminthosporium teres*, of which an abstract has already been noticed [*R.A.M.*, vi, p. 721]. The data [which are presented in tabular form] showed that the varieties of the two-rowed species, *Hordeum distichum*, are more resistant to the fungus than those of the six-rowed forms of *H. vulgare*. Of the four-rowed barleys (*H. vulgare* subsp. *tetrastichum*), the hulled, black, awned varieties, *nigrum* and *leiorrhynchum*, are more susceptible than the naked and furcate varieties. Of the two-rowed varieties, *nudum* is the most susceptible and *erectum* the most resistant.

The character of immunity from *H. teres* was found to be constant and to behave according to Mendel's law in crosses.

The symptoms produced on barley by *H. teres* are described as similar to those caused by *H. sativum*.

Brooks (F. T.). **Observations on Rhynchosporium secalis (Oud.) Davis, leaf blotch of Barley and Rye.**—*New Phytologist*, xxvii, 4, pp. 215–219, 1 pl., 3 figs., 1928.

Since 1919, when leaf blotch of barley and rye (*Rhynchosporium secalis*) [*R.A.M.*, vi, p. 596] was first recorded in Britain (*Min. of Agric. Misc. Publ.* 33), the writer has made a constant study of this disease in the vicinity of Cambridge, where *Bromus sterilis*, *B. mollis*, and *Dactylis glomerata* are also attacked.

The disease is most prevalent on barley during the latter part of the winter and early spring, and is also common on self-sown barley plants during the autumn. Affected plants may outgrow the disease, and the freshly produced foliage may then be almost free from infection.

R. secalis may attack any part of the leaves, producing irregular spots or blotches. On barley the auricles are frequently infected, possibly because of their retention of moisture. The blotches first appear as water soaked areas with greyish centres and brown margins. Bicellular spores with prominent beaks, measuring 11 to 16 by 3·5 to 5 μ, are produced over almost the whole of the blotches on either side of the leaf. The hyphae penetrate the epidermis from the mesophyll and distribute themselves partly under the cuticle and partly in the epidermal cells. These hyphae become divided by transverse septa into small, regular cells, which produce small protuberances by budding. The latter organs rupture the cuticle and develop into curved, uniseptate spores. No conidiophores were observed by the writer in the stomata of the leaves, and most of the spores, if not all, seem to be formed by the above method.

In cultures on Dox's medium or barley extract agar a sparse mycelium, rapidly producing spores from unspecialized cells, is formed. In culture the spores are curved or straight, mostly uni-, but occasionally bi- or triseptate. No indication of a yeast-like mode of development, as described by Heinsen, was observed.

Unwounded barley leaves were successfully inoculated by placing an emulsion of the spores in water on either surface. No evidence of the persistence of *R. secalis* in the soil was obtained, but its survival from one season to another is sufficiently explained by its occurrence on the above-mentioned wild grasses and on self-sown barley.

Garber (R. J.), Giddings (N. J.), & Hoover (M. M.). **Breeding for disease resistance with particular reference to the smut of Oats.**—*Scient. Agric.*, ix, 2, pp. 103–115, 1928.

After a brief survey of recent progress in the study of the inheritance of disease resistance in cereals, the writers describe and tabulate their recent investigations at the West Virginia Agricultural Experiment Station on the selection and breeding of maize and oats for resistance to smuts.

A number of selfed lines of maize grown continuously for seven years under conditions favouring smut (*Ustilago zeae*) have shown marked differences in their reaction to this disease [*R.A.M.*, vii, p. 779]. Five of these lines consistently showed a high degree of resistance, the average infection from 1922 to 1927, inclusive, ranging only from 1·1 to 2·1 per cent. Four other lines showed a moderately high average of smut infection (19·9 to 32·3 per

cent.), while the average for the tenth was 54 per cent. Certain strains further exhibited striking divergences in the point of attack by the fungus, some being predominantly infected in the tassel, and others in the ears, leaves, or stem bases, respectively.

In 1926 and 1927 an investigation was conducted to determine the mode of inheritance of resistance in oats to loose and covered smut (*Ustilago avenae* and *U. levis*), of which the former is stated to be the more common and destructive in West Virginia. Details are given of the methods used to induce a smut epidemic and of the classification of the progeny resulting from a cross between the moderately susceptible Gopher and the resistant Black Mesdag varieties [ibid., vii, pp. 573, 627]. The seed-grain was infected by placing it in an envelope with a 'pinch' of smut and shaking vigorously; three to four weeks later (first fortnight of June) it was sown under controlled conditions.

Of the 100 F_3 families 21 showed no smutted plants, thereby indicating that a single main factor difference was responsible for resistance. The range in the percentage of smutted plants among the remaining 79 F_3 families was from a class centre of 2·5 to one of 67·5. The majority of the families containing smutted plants (59) fell into three classes, with centres of 2·5, 7·5, and 12·5 per cent., respectively. Fifteen families showed smut percentages between 20 and 45, and five fell between 50 and 70. This last class indicated transgressive segregation for smut susceptibility, since the highest infection on the susceptible Gopher parent was 39·9 per cent. A study of the 158 F_4 families from plant selections of 30 different F_3 families showed that segregation occurred in every case in the F_4 where a low percentage of smut was found in the F_3 generation. Of the five F_3 families showing between 20 and 29·9 per cent. infection tested, three were apparently homozygous for at least one main factor difference for susceptibility, and two segregated. The five highly susceptible, and eleven of the twelve apparently immune F_3 lines that were continued bred true for their respective characters in the F_4 generation. The data from the F_4 generation confirmed the view that there is a single main factor difference operating to determine resistance. However, at least one other factor, presumably introduced by Black Mesdag, and possibly correlated with the black seed colour, causes transgressive segregation for susceptibility. In the F_4 generation, again, segregates were obtained which were more susceptible to smut than the susceptible Gopher parent.

A preliminary account is given of the results of a study on the inheritance of certain other characters in addition to smut. No evidence was secured of genetic linkage between smut susceptibility and earliness, or width of leaf.

IMMER (F. R.) & STEVENSON (F. J.). **A biometrical study of factors affecting yield in Oats.**—*Journ. Amer. Soc. Agron.*, xx, 10, pp. 1108–1119, 1928.

A biometrical investigation was made of the factors, including infection with crown rust (*Puccinia coronata*) [*P. lolii*], affecting yield in oats at four localities in Minnesota during 1927. The selected lines of oats used were immune from loose and covered

smuts [*Ustilago avenae* and *U. levis*] and resistant to stem rust [*P. graminis*].

The crown rust epidemic of 1927 was the most severe experienced in Minnesota of recent years. It was found that an increase of 1 per cent. in crown rust caused an average reduction in yield of 0·32 bushels per acre. Since some of the lines showed 65 per cent. more infection than others, it could be inferred that the yields of the most susceptible lines were reduced 20 bushels per acre by crown rust as compared with the more resistant strains. Under such conditions breeding for crown rust resistance assumes considerable importance.

DRECHSLER (C.). **Pythium arrhenomanes n. sp., a parasite causing Maize root rot.**—*Phytopath.*, xviii, 10, pp. 873–875, 1928.

A study has been made of the *Pythium* isolated by Helen Johann and her collaborators from the decayed roots of Dent maize in Wisconsin and Illinois [*R.A.M.*, v, p. 485]. In some respects this organism resembles that associated by Carpenter with root rot of sugar-cane in Hawaii [ibid., viii, p. 34], but some significant differences exist between the two species in respect of the mycelial relationships of the antheridia and the number of these bodies to each oogonium. In the cane-root fungus the maximum number of antheridia appears, from the illustrations, to be six, while in the maize parasite these organs probably reach a total of 25 to 30. The *Pythium* isolated from maize differs from *P. aphanidermatum* [loc. cit.] in the shape of its antheridia, which are crook-necked, expanded, terminal or lateral structures making a narrow contact with the oogonium and never furnished with more than one cross-wall. Carpenter's plates also illustrate this type of antheridium, and it is therefore evident that the cane fungus cannot be identified with *P. aphanidermatum*, in which the antheridium is represented by a terminal, subterminal, or intercalary portion of a hypha, delimited by one or two septa, together with a massive orbicular, barrel- or dome-shaped protuberant part making a broad apical contact with the oogonium. Isolations from diseased maize rootlets typical of the Kentucky form of root rot [ibid., vi, p. 90] yielded a preponderance of a *Pythium*-like organism closely allied to the Wisconsin fungus.

The maize parasite studied by the author is considered to be a new species, and the name of *P. arrhenomanes*, suggesting an extraordinary supply of male elements, is proposed for it [an English diagnosis being given]. It is characterized by an inter- and intracellular mycelium with hyphae 2 to 5·5 μ in diameter. The zoosporangia are lobulate, composed of inflated communicating elements up to 20 μ or more in diameter, often occurring in extensive complexes; the evacuation tube usually measures 3 to 4 μ in diameter, and varies in length (often between 50 and 75 μ); 20 to 50 biciliate, motile, later subspherical or ellipsoid zoospores, measuring about 12 μ in diameter, and usually germinating by a single tube, 2·5 to 3 μ in diameter, are developed in a vesicle. On carrot-cornmeal agar the subspherical, terminal, occasionally intercalary oogonia measure 24 to 35 μ (average 29·4 μ) in diameter, with a wall about 0·5 μ thick. The antheridia are borne terminally or

more rarely laterally on branches arising from 4 to 8 hyphae; they measure 6 to 9 μ in the distal expanded portion and 12 to 25 μ in length from apex to basal septum along the curved axis. The subspherical, yellowish oospores, sometimes completely filling the oogonium, usually measure 22 to 33 μ (average 27·3 μ) in diameter, and are surrounded by a wall 1·2 to 2 μ (average 1·6 μ) in thickness.

BARTHOLOMEW (E. T.). **Internal decline (endoxerosis) of Lemons. V. Concerning the comparative rates of water conduction in twigs and fruits.**—*Amer. Journ. of Botany*, xv, 8, pp. 497–508, 1 diag., 1928.

Continuing his studies on internal decline or endoxerosis of lemons [*R.A.M.*, v, p. 667], the writer ascertained, by means of auxographic records, that affected fruits began to shrink 1 hour and 25 minutes later, and to expand 1 hour and 10 minutes later, than healthy ones. This indicated either an inherent difference in the water-conducting capacities of the two sets of twigs, or the existence, in the endoxerotic fruits or twigs, of some condition acting as a barrier to normal water conduction.

By removing both healthy and endoxerotic lemons from their pedicels and attaching potometers to the ends of the twigs adhering to the trees, it was found that the twigs bearing healthy fruits withdrew almost twice as much water from the potometers as those bearing diseased ones. Hence it may be inferred that some condition in the twigs bearing the endoxerotic fruits, and not in the lemons themselves, was mainly responsible for the delay in the rate of water conduction.

By a comparison of the amounts of carbon dioxide gas that could be forced through healthy and affected twigs, respectively, further evidence was obtained that some condition in the twigs bearing endoxerotic fruits prevented rapid water conduction. The healthy twigs conducted larger amounts of gas than the endoxerotic ones until the distal portion of the twigs had been removed to a point 2 to 6 cm. behind the fruit, after which the rates of conduction were approximately equal. No evidence was obtained that a difference in the number of vessels in the xylem of the twigs, in the lengths of their open segments, or in their cross-sectional area could account for the more rapid water and gas conduction in healthy than in endoxerotic fruits, and microscopic examination failed to reveal any tyloses in the vessels of either set of twigs [see next abstract].

BARTHOLOMEW (E. T.). **Internal decline (endoxerosis) of Lemons. VI. Gum formation in the Lemon fruit and its twig.**—*Amer. Journ. of Botany*, xv, 9, pp. 548–563, 2 pl., 1928.

Continuing his investigations on internal decline (endoxerosis) of lemons [see preceding abstract], the writer found that the presence of gum in the vessels of the fruit and of the distal end of the twigs on which they were borne materially reduced their conductivity. In the buttons where the bundles had not yet joined to form a continuous zone the gum was apparently not restricted to any particular bundles; in the pedicel it was at first confined to the portion of the xylem bordering the pith, but in the final stages

it could be found in any of the vessels practically out to the cambium; while in the twig the gum, even in the most severe cases, was almost exclusively limited to the inner half of the xylem.

The formation of gum in the twig ceased after the removal of the gumming fruit, and the twig continued to make normal growth. In no case examined was gum found beyond a length of 6 cm. in the twig.

Where gumming lemons were borne singly at the end of a twig gum was found in any portion of the inner xylem of the twig, whereas if healthy and gumming fruits were borne on adjacent pedicels at the end of a single twig, or if the gumming fruit developed laterally, gum was found only in that portion of the xylem immediately below the gumming fruit.

The middle lamella and the cellulose wall appear to constitute the principal source of the gum in the fruit. The phloem seems to disintegrate first, then the bundle sheath, and ultimately the parenchyma between the bundles. In many cases observed the tissues were completely destroyed and gum pockets formed.

In the twig the principal source of the gum was evidently starch, but the middle lamella and the cellulose wall were also somewhat affected. No gum pockets were found in the twigs. As the disintegration progressed the decomposition products traversed the pits and collected in droplets on the inner face of the vessel wall.

A high proportion of the gummy substance remained water-soluble for some time (up to a week or ten days) after migration into the vessels. Eventually, however, it became insoluble in water, and in this state it should probably be designated wound gum.

WHITTIER (D. H. R.). **Preventing decay in Oranges. Experiences in California. Brogdex and carbonate of soda washes compared.**—*Fruit World of Australasia*, xxix, 10, pp. 387–388, 1 fig., 1928.

In view of the expense involved in paying the royalty demanded by the Brogdex Company (who have established their patent-rights in the United States Courts) for the use of borax in the control of decay of citrus fruits [cf. *R.A.M.*, viii, p. 50], the author points out that bicarbonate of soda is both cheap and satisfactory for this purpose. In 400 lb. barrels it costs in America about $1\frac{1}{4}d.$ per lb.; a 3·75 to 4 per cent. solution is used in water at 95° to 100° F., this heat also accelerating drying. The oranges go into warm soap water first, through brushes, under a water spray, and into the soda tank. Many companies do not trouble to clean the tank throughout the season.

CORTEZ (F.). **Gray spot, or blight of Coconut.**—*Philipp. Agric.*, xvii, 5, pp. 223–235, 3 pl., 1928.

A full account is given of grey spot or blight, caused by *Pestalozzia palmarum* [*R.A.M.*, vi, p. 698], which is stated to be the most common disease of coco-nut palms in the Philippines. The morphological and cultural characters of the fungus are described. The fusiform, somewhat curved spores measure 11·7 to 28·3 by 3·3 to 6·7 μ (average 19 by 4·7 μ) in pure culture and 14·4 to 21·6 by

4·7 to 7·2 μ (average 18·3 by 6·1 μ) on the leaves. These measurements agree closely with those recorded by Bertus from Ceylon [ibid., ii, p. 527]. They usually have one to three (occasionally four) hyaline appendages, and contain three brown cells (sometimes up to five). The average length of the coloured part of the spore is 12 and 11·2 μ in culture and in nature, respectively. The spores germinate in about 4½ hours in sterile rain water. *P. palmarum* was found to be capable of infecting *Arenga saccharifera, Caryota cumingii, Areca catechu, Oreodoxa* [*Roystonea*] *regia*, and *Phycosperma macarthurii* in addition to coco-nuts. Infection only takes place through wounds. Suggested control measures include the cutting and burning of infected leaves *in situ* and the application of standard Bordeaux mixture with a resin-sal soda sticker.

JONES (G. H.). **An Alternaria disease of the Cotton plant.**—*Ann. of Botany*, xlii, 168, pp. 935–947, 1 pl., 6 figs., 1 graph, 1928.

During 1924, leaf and boll injury was caused to the native cotton varieties of *Gossypium peruvianum* and *G. vitifolium* in Nigeria by a species of *Alternaria* [*R.A.M.*, vii, p. 318]. On the cotyledons and leaves the lesions appeared as minute, brown, circular spots bordered by a narrow purple rim, and on reaching some 2 mm. in diameter showed a grey, dry, cracked centre. Mature spots seldom exceeded 1 cm. in diameter, usually showed concentric zonation, and were most clearly defined on the upper surface of the leaf, where the spores were borne.

On buds, flowers, and bolls the small round lesions were almost invariably noted on the glandular areas alternating with the points of insertion of the bracts upon the receptacle. Most commonly, infection occurred a few days before flowering.

Inoculation experiments [details of which are given] with pure cultures of the fungus gave positive results on unwounded leaves. The hyphae are situated chiefly between the epidermal cells, but occasionally send down branches between those of the palisade tissue. On the glandular area of the bud and boll, inoculation resulted in the penetration of the fungus between the cells deeply into the receptacle.

On the leaf the fungus bore large, dark conidia with narrow, hyaline beaks at least as long as the thicker part; the spores, including the beak, measured 74 to 150 by 10 to 18 μ, and were usually single, very rarely in chains of two. Comparison with the description and figure of *A. macrospora* Zimmerm. from Tanganyika, with type material of *Sporodesmium longipedicellatum* Reichert from Egypt, with an *Alternaria* sent by Small from Uganda, and one sent by Briton-Jones from Trinidad showed that all agreed closely in size and shape but were larger than the Nigerian fungus. The author considers, provisionally, that the different strains all belong to one species, for which the oldest specific name, *A. macrospora* Zimmerm. is adopted.

The disease causes some shedding of the flowers and young bolls, and on older bolls produces a mummified condition. An internal rot of the bolls was caused by artificial inoculation. In open moderately dry country it causes relatively little damage, but it might possibly become important under very humid conditions.

PULSELLI (A.). **La Sphaerostilbe coccophila Tul. come parassita dell' Aonidia lauri Bouché e di altri insetti.** [*Sphaerostilbe coccophila* Tul. as a parasite of *Aonidia lauri* Bouché and other insects.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 3, pp. 262–283, 1 col. pl., 10 figs., 1928.

After a full account of the life-cycle of *Sphaerostilbe coccophila* [*R.A.M.*, vii, p. 375] as found on *Aonidia lauri* parasitizing *Laurus nobilis* in Italy, the author discusses the systematic position of the fungus, and states that from a study of their morphological and cultural characteristics he considers that *Microcera coccophila* Desm. [loc. cit.], *Fusarium baccharidicola* Henn., *S. coccophila* Tul., and *Nectria coccidophthora* Zimm., are all the same fungus; for reasons of priority he adopts the names *M. coccophila* and *S. coccophila* for the imperfect and perfect stages, respectively. From his experiments [which are described in detail] upon the artificial infection of *A. lauri* by the fungus under natural conditions, the author concludes that this does not offer a practical means of control of the scale insect in Italy, where the weather conditions do not sufficiently favour the germination of the spores.

BUTLER (E. J.). **Morphology of the Chytridiacean fungus, Catenaria anguillulae, in liver-fluke eggs.**—*Ann. of Botany*, xlii, 168, pp. 813–821, 19 figs., 1928.

The author gives the history of the genus *Catenaria* and an account of the morphology of *C. anguillulae* in eggs of the liver-fluke of sheep (*Fasciola hepatica*) received from Ireland [*R.A.M.*, vii, p. 375]. The dimensions are larger than those previously recorded, but do not differ more from those of the organism referred by Dangeard to this species in France, than did the latter from Sorokin's original description of Russian specimens.

Catenaria is regarded as belonging to the Cladochytriaceae, rather than to the Ancylistaceae as suggested by Dangeard.

SABOURAUD (R.). **Sur la nouvelle classification des Dermatophytes proposée par M. Grigorakis.** [On the new classification of Dermatophytes proposed by M. Grigorakis.]—*Ann. de Parasitol. Humaine et Comp.*, vi, 4, pp. 455–469, 1928.

A full analysis and discussion are given of Grigorakis's recent thesis entitled 'Contribution à l'étude des teignes et de leurs parasites' (Imprimerie Bascou, Lyons, 1928), which is stated to be a revised and amended version of his previous studies on the dermatophytes [*R.A.M.*, iv, p. 736]. Summarizing his conclusions as to the value of the work, the writer considers that the bulk of the observations are based (without due acknowledgement) on the researches of others, while the main argument (that of the progressive degeneration of the dermatophytes on certain culture media) is by no means substantiated.

LANGERON (M.). **Travaux récents sur la classification des Dermatophytes.** [Recent studies on the classification of the Dermatophytes.]—*Ann. de Parasitol. Humaine et Comp.*, vi, 4, pp. 470–476, 1928.

This is a criticism of Grigorakis's thesis on the classification of

the dermatophytes [see preceding abstract]. The hypotheses on which the proposed system of nomenclature is based are briefly examined and considered to be untenable.

WILENCZYK (A.). **Du polymorphisme et du pléomorphisme des teignes.** [On the polymorphism and pleomorphism of the ringworms.]—*Comptes rendus Soc. de Biol.*, xcix, 27, pp. 1025–1026, 1 fig., 1928.

A distinction is drawn between polymorphism in fungi, expressed by modifications in certain morphological characters and by change of appearance due to external conditions, and pleomorphism, characterized by definite, hereditary, and irreversible alterations manifested by the development of new reproductive organs. *Trichophyton violaceum* assumes a pinkish to violet coloration at room temperature, while at 37° C. the original yellow tinge is preserved. Fluctuations of this type are typical of polymorphism. Hanging-drop cultures of *Achorion schoenleini* in bouillon at 37° were found to develop aerial hyphae bearing on both sides bunches of conidia and pluriseptate spindles closely resembling those of *Trichophyton*. This is considered to be an instance of true pleomorphism.

TAKAHASHI (S.). **Über Trichophytie und ihre Erreger in Sapporo-Gegend.** [On trichophytosis and its causal organisms in the Sapporo district.]—*Japanese Journ. of Dermatology*, xxviii, 5, pp. 542–550, 3 figs., 1928. [Japanese, with German summary on pp. 35–36.]

In 61 cases of trichophytosis examined by the author in the Sapporo district (Hokkaido, Japan), the following fungi occurred (in order of frequency): *Microsporon japonicum* Dohi & Kambayashi (= *M. ferrugineum*) [*R.A.M.*, vii, p. 634] 25, *Trichophyton purpureum* 18, *T. interdigitale* and *T. violaceum* 5 each, *Epidermophyton inguinale* 4, and *T. radiolatum*, *T. purpureum* var., and *T. farinulentum* (?) 1 each. The last-named fungus, which was readily transmissible to rabbits, forms prominent, light brown, deeply furcate colonies on agar (white with greenish-yellow, brownish, or reddish-brown centres in subcultures). It bears multilocular fusiform elements, terminal and intercalary chlamydospores, and aleuria.

PAYENNEVILLE & MARIE. **Un cas de favus (Achorion de Schoenlein) de la paupière et du cuir chevelu, chez un nourrisson de 16 jours.** [A case of favus (*Achorion schoenleini*) of the eyelid and scalp in a 16-day-old infant.]—*Bull. Soc. Franç. de Dermatol., 1928*, 7, pp. 567–569, 2 figs., 1928.

A brief account is given of what is believed to be a unique case of favus due to *Achorion schoenleini* in the left eyelid and in a scalp lesion on a 16-day-old infant. It was impossible to trace the source of infection.

LANGERON (M.). **Mycétome à Torula jeanselmei Langeron, 1928, nouveau type de mycétome à grains noirs.** [Mycetoma due to *Torula jeanselmei* Langeron, 1928, a new type of black-grained mycetoma.]—*Ann. de Parasitol. Humaine et Comp.*, vi, 4, pp. 385–403, 12 figs., 1928.

This is an extended description of the black-grained mycetoma

on the foot of a native of Martinique, a preliminary account of which has already been noticed [*R.A.M.*, vii, p. 640]. *Torula jeanselmei* is characterized in culture by a filamentous, often coremiate, fuliginous mycelium with branched, septate hyphae usually composed at the base of short swollen cells measuring 5 to 5·5 μ in diameter. The aerial hyphae are 2 to 2·5 μ in diameter, and bear rounded or elongated, very fragile, sessile or, less often, pedicellate, lateral or terminal blastospores, the lateral ones developing singly or in pairs immediately below a septum and the terminal occurring in clusters of 3 to 8 at the apices of the lateral branches. The blastospores, which measure 5 by 2·5 μ, fall off readily and develop small colonies of toruloid mycelium by budding. Arthrospores are formed by the breaking up of the toruloid elements at the base of the hyphae. The black grains from which the fungus was isolated measured 500 to 1,000 μ in diameter.

IKATA (S.). **Fungous diseases of the Insect-powder plant.**—*Ann. Phytopath. Soc. Japan*, ii, 2, pp. 140–158, 2 pl., 1928. [Japanese, with English summary.]

Notes are given on the following diseases of the insect-powder plant (*Chrysanthemum cinerariaefolium*) in the Okayama prefecture of Japan. Blight of the leaves, petioles, flowers, and stems is caused by a new species of *Diplodia*, *D. chrysanthemella*, characterized by immersed or erumpent, flask-shaped or irregular, black pycnidia with a diameter of 60 to 141 μ (average 100 μ) in nature and up to 360 μ in culture (acid standard agar). The ellipsoid pycnospores are hyaline and unicellular when young, usually bi- or rarely tricellular and brown or light olive at maturity, and measure 6 to 13 by 3 to 6 μ (average 11 by 3·6 μ). The conidiophores are very short and slender.

The small sclerotium disease, caused by *Sclerotinia minor*, affects the stems and leaves at the base of the plant, resulting in wilt and decay. The fungus, which is also known to occur on lettuce, celery, and other crops in America [*R.A.M.*, v, p. 269], has apparently not been previously recorded from Japan. It is characterized by minute sclerotia resembling onion seeds, and measuring 0·2 to 4 mm. in diameter (average 0·5 to 2 mm.). Disk-shaped apothecia, 0·5 to 2 mm. in diameter, with slender stalks 2 to 5 mm. long and 0·3 to 0·5 mm. in diameter, are produced, singly or in pairs, from the sclerotia. Microconidia are formed in culture but were not seen in nature. Inoculation experiments with *S. minor* on lettuce, celery, and various other plants gave positive results.

The large sclerotium disease, caused by *S. libertiana* [*S. sclerotiorum*], produces similar symptoms to those of *S. minor*, but the fungi are readily distinguishable, even in nature, by the larger sclerotial dimensions of the former (2 by 2 to 12 by 7 mm., average 6 by 3·6 mm.).

Sclerotium wilt, due to *S. rolfsii*, is widely distributed on chrysanthemum and other cultivated plants in Japan, but is stated to cause little damage.

An undetermined species of *Fusarium* attacks the leaves and stems of *C. cinerariaefolium*, causing a wilt and greyish-black discoloration of the base.

Black spot disease is caused by *Septoria chrysanthemella* [ibid., vii, p. 244].

NANNIZZI (A.). **Una Pleospora dannosa alla Rosa banksiae R. Br.** [A *Pleospora* harmful to *Rosa banksiae* R. Br.]—*Riv. Pat. Veg.*, xviii, 9–10, pp. 185–191, 1928.

In August, 1928, spots bounded by a reddish-brown ring appeared at the tips of the leaves of two *Rosa banksiae* bushes in the Botanical Gardens, Siena, this being followed on one bush by the withering of the distal part of the leaf, which bore the perithecia of a species of *Pleospora*.

The fungus differed from *P. herbarum* only in the coriaceous or subcarbonaceous consistency of the perithecia and the cylindrical shape of the asci, and is accordingly named *P. herbarum* f. *rosae banksiae* f. n., a Latin diagnosis being given.

Notes are given on various other species and forms of *Pleospora* that have been described as plant parasites.

MARTIN (G. H.) & CHARLES (VERA K.). **Preliminary studies of the life history of Erostrotheca multiformis, the perfect stage of Cladosporium album Dowson.**—*Phytopath.*, xviii, 10, pp. 839–846, 5 pl., 1928.

In April, 1927, the authors received from Massachusetts some specimens of sweet peas (*Lathyrus odoratus*) attacked by *Cladosporium album* [*R.A.M.*, iii, p. 651]. Subsequently the disease, for which the term 'white blight' is suggested, was reported from New York and Pennsylvania. In all cases it caused serious loss.

In culture the following conidial forms developed and proved capable of initiating new infections: *C. album* and forms of *Hormodendrum*, *Ovularia*, *Haplaria*, *Pseudofumago*, and *Pseudosaccharomyces*. A perithecial stage was also obtained in cultures from New York specimens, while pseudosclerotia developed on the diseased leaves. The life-cycle of the sweet pea organism agrees with that of *C. citri* [ibid., iv, p. 476], except that the latter possesses a pycnidial stage, *Rhynchodiplodia citri*, but no perfect one, while the former has a perithecial, but no pycnidial, stage.

The perfect stage of the sweet pea fungus is allied to the genera *Melanospora*, *Neurospora*, and *Sphaeroderma* and is made the type of a new genus of the Hypocreaceae as *Erostrotheca multiformis*. The perithecia, which develop in six-day-old cultures and mature in about three weeks, are gregarious or scattered, zonate on cornmeal agar, capucine yellow (later mahogany red); the asci are clavate, aparaphysate, short stipitate, and measure 20 to 25 by 12 to 16 μ; they contain eight irregularly biseriate, elliptical, dark citrine to olive-yellow ascospores, flattened on one side. The various conidial forms are described briefly. The *Hormodendrum* differs from *H. cladosporioides* [*C. herbarum*] only in having larger hyaline conidia. The *Pseudosaccharomyces* closely resembled various fungi that have been referred to the genus *Kabatiella* [ibid., iv, p. 129] and also *Polyspora lini*. Transitional stages between this

and the *Pseudofumago* form were observed. The *Haplaria* has papillose conidiophores with conidia 6 to 8 by 2 to 4 μ in diameter; and the *Ovularia* spores are 3·5 to 4·5 by 1·5 to 2·5 μ, often adhering in heads.

MAINS (E. B.). **Observations concerning Clover diseases.**—*Proc. Indiana Acad. Sci.*, xxxvii (*1927*), pp. 355–364, 6 figs., 1928. [Received January, 1929.]

Popular notes are given on the following diseases of clover observed during the period 1920–27 near Lafayette, Indiana. Anthracnose (*Gloeosporium caulivorum* [*Kabatiella caulivora*] and *Colletotrichum trifolii*) was prevalent in 1926 and 1927 [*R.A.M.*, vii, p. 583]. *K. caulivora* produced moderate to slight infection on the French, Italian, Altaswede, Indiana, Oregon, Hungarian, Rumanian, and Polish strains, while a Chilean and most of the North American strains proved nearly immune. In the autumn of 1927 *C. trifolii* caused heavy damage on the Oregon and Idaho strains.

In 1927 powdery mildew (*Erysiphe polygoni*) [ibid., v, pp. 673, 723] was most severe on various American strains, a number of foreign strains being little affected. Dusting with sulphur gave good control in 1927.

Bacterial leaf spot (*Bacterium trifoliorum*) [ibid., iii, p. 654] was first observed causing heavy infection of red clover [*Trifolium pratense*] in 1925. The water soaked spots exude a substance imparting a dark varnished appearance to the infected areas, which dry up and break away. Considerable defoliation may occur in cases of heavy infection, which are apparently favoured by the low temperatures of the spring months and seem to be confined to the first cutting. In 1926 the foreign strains, as a group, were more susceptible than the North American.

Macrosporium sarcinaeforme [ibid., vii, p. 380] was abundant in 1927 on various French, German, Hungarian, and North American strains.

Rust (*Uromyces fallens* or *U. trifolii*) caused heavy damage in the autumn of 1920 on the Indiana, North and South Dakota, and Ohio strains, Italian being resistant. In a greenhouse test made during 1922–3, 6·6 per cent. of three North American strains were classed as resistant, the corresponding figures for the four Chilean, four eastern European, four French, and three Italian strains being 20, 18·7, 26·9, and 19·7 per cent., respectively. These selections were also resistant to powdery mildew. *U. trifolii-hybridi* [*U. hybridi*: ibid., iv, p. 170] has been frequently observed on alsike clover [*T. hybridum*] and in 1927 *U. trifolii-repentis* was found on white clover [*T. repens*].

Mosaic occurred on a number of species and strains. A species of *Cercospora* attacked *T. hybridum* in 1923. Sooty spot of white clover (*Phyllachora* [*Dothidella*] *trifolii*) has been observed every year, occasionally in a severe form. Various root and crown rots associated with *Fusarium* spp. and other fungi [ibid., vi, p. 558] have also been noticed, especially among the French and Italian plots in 1926.

Haber (Julia M.). **The relationship between Bacillus amylovorus and leaf tissues of the Apple.**—*Pennsylvania Agric. Exper. Stat. Bull.* 228, 12 pp., 2 pl., 1928.

Recent investigations by Nixon (*Pennsylvania Agric. Exper. Stat. Bull.* 212, 1927) have shown that the life-cycle of *Bacillus amylovorus* in apple stems comprises two phases, viz., a vegetative stage and one of pseudo-fructification. In the former phase the zoogloeae migrate through the intercellular spaces of the cortex, forming schizogenous cavities, while in the latter the organism becomes intracellular and there is a formation of lysigenous cavities in which eventually bacterial cysts, representing the winter condition of the organism, develop.

The material used in the author's studies consisted of young leaves on shoots or water sprouts of apples grown in the greenhouse. Five series of inoculations were made by needle pricks in May and four in December (158 in all).

About 94 per cent. of the inoculations proved successful. In material examined 15 minutes to one hour after inoculation, single masses composed of six or seven bacteria were evident in the borders of the wound. After 1½ hours groups of bacteria embedded in a zoogloeal matrix, irregular in shape but with a uniformly even surface and a clearly defined border, form in the intercellular spaces of the spongy mesophyll adjacent to the wound. The advancing tip of the zoogloea develops a scalloped edge and each rounded projection forms a new pseudopodium-like protrusion which ultimately advances in a fresh direction. When an intercellular space is invaded the matrix proceeds first with a few bacilli, while the remainder of the organisms stream along and are distributed round the periphery of the matrix. The branches of the zoogloeae nearest the point of infection become crowded with bacteria so that the matrix seems to be obliterated.

If the inoculum traverses a vein, the resultant infection seems to spread most readily in the surrounding parenchyma. In the region of the midrib the zoogloeae first develop in the vein parenchyma about four or five cells below the epidermis, whence migration proceeds in every direction before eventually tending towards the epidermis. In one case the zoogloeal tip reached a substomatal air chamber, from below, within 24 hours after inoculation.

In material examined about one hour after inoculation the zoogloeae were found to have travelled a distance of 0·0195 mm.; in six hours 0·08763 mm.; in eight hours 0·381 mm.; and in twelve hours 0·5715 mm. In 24 hours the pseudopodium-like structure had migrated tangentially a distance of 1·4 mm. in the parenchyma of the midrib.

The host cells may become almost completely surrounded by bacilli without showing any apparent change. Then there is a slight gradual plasmolysis, accompanied by the disintegration of the starch granules and destruction of the plastids. Eventually the protoplast is destroyed and the cell walls collapse owing to the pressure of the bacteria, with the formation of schizogenous cavities, which often unite. There is no indication of the complete dissolution of the cell walls or the contents of the invaded cells, nor

do the bacteria appear to enter the cells and form the cyst-like bodies observed by Nixon [*R.A.M.*, iv, p. 432].

MILLER (P. W.). **A preliminary report on studies of fireblight of Apple.**—*Science*, N.S , lxviii, 1764, pp. 386–388, 1928.

For three years the writer has continued Brooks's studies on the epidemiology and control of fireblight of apple (*Bacillus amylovorus*) in Wisconsin [*R.A.M.*, vi, p. 234; vii, p. 494]. In each of these three seasons the earliest infections of both blossom clusters and young shoots have been observed to occur almost invariably below hold-over cankers or twigs in positions favourable for water-borne dissemination of the bacteria. In 1926 and 1927 young blossom clusters were found blighted well before the opening of the blossoms and at a time when there was a marked dearth of insect carriers. During the three years of the investigation no insect was observed to visit the bacterial exudate. The occurrence of primary infection was correlated with rainy periods.

Abundant infection of the young shoots and unopened blossoms of apple and pear may be obtained by spraying them with a suspension of *B. amylovorus* in sterile distilled water and placing them for varying periods in a moist chamber at suitable temperatures. Cases of stomatal penetration have been observed in tissues taken from (*a*) an inoculated young apple-leaf, and (*b*) the inside of the receptacle cups of apple and pear flowers that were open when inoculated. The results of field experiments supported those of the greenhouse series.

These data suggest that the rôle of insects in the dissemination of fireblight is less important than was formerly believed. Excision of the cankers and the application of fungicides to the lesions appear to be promising methods of control.

FRAMPTON (Miss A. M.). **Preliminary report on the incidence and control of Apple scab and Apple mildew.**—*Ann. Rept. East Malling Res. Stat. 1926 and 1927, II Supplement*, pp. 96–107, 1928.

In 1926, trials were conducted at East Malling Research Station, Kent, upon a four-year-old plot of Cox's Orange Pippin and Stirling Castle apple trees grafted on various stocks, to test the efficacy of different spray fluids in the control of scab [*Venturia inaequalis*] and mildew [*Podosphaera leucotricha*]. The results [which are tabulated and discussed] are briefly as follows.

With Cox's Orange Pippin a pre-blossom application of lime-sulphur 1 in 29 or Bordeaux mixture 8-8-100 gave almost complete control of scab for seven weeks, but the addition of lead arsenate did not appear to increase the fungicidal value against this organism of either mixture. The lime-sulphur scorched the young leaves but caused no defoliation; the Bordeaux mixture did not injure the foliage. Post-blossom sprays made on 31st May and 13th July with lime-sulphur 1 in 100 or Bordeaux mixture 8–25–100 proved similarly fungicidal, the latter being slightly the more effective and causing far less defoliation of the younger leaves than did the lime-sulphur, though both caused considerable dropping of the older leaves. There were indications that one application of

Bordeaux mixture protected the foliage to some extent against injurious effects from a second application. No influence of the stock upon scab infection of the leaf was noted, but there were indications that the stock influences the amount of spray injury and considerably affects the resistance of the wood to scab.

Post-blossom applications of colloidal sulphur (5 lb. per 100 galls.) had no fungicidal effect on scab.

The Stirling Castle trees showed so little mildew that no estimate could be formed of the fungicidal value against *P. leucotricha* of the sprays used. A pre-blossom spray with ammonium polysulphide 1 in 100 caused no damage to the foliage, while one with lime-sulphur 1 in 29 scorched the young leaves but did not cause defoliation. Post-blossom sprays applied on 31st May and 13th July with lime-sulphur 1 in 100 and with colloidal sulphur caused considerable dropping of the young leaves, while others with ammonium polysulphide 1 in 200 caused some leaf fall, but less than did two similar applications of lime-sulphur 1 in 150. A post-blossom application of liver of sulphur caused little defoliation. No significant difference was observed between the damage caused by one and two applications of any treatment.

BOYLE (C.), MURPHY (M.), & CUMMINS (H. A.). **'Blossom-wilt' of Apple trees and 'wither-tip' of Plum trees, with special reference to two biologic forms of Monilia cinerea Bon.**—*Scient. Proc. Roy. Dublin Soc.*, N.S., xix, 1–8, pp. 63–76, 3 pl., 1928.

In the summer of 1922, Czar and Victoria plum trees in an orchard near Cork became affected with wither-tip, and in the following spring adjacent Cox's Orange Pippin and Worcester Pearmain apples showed signs of blossom-wilt, the young shoots withering back and later bearing the pustules of *Monilia* [*Sclerotinia*] *cinerea*.

Investigations [details of which are given] made to ascertain whether two distinct forms of *S. cinerea* corresponding to Wormald's forma *pruni* and f. *mali* [*R.A.M.*, vi, p. 619] existed in Ireland showed that the conidia of the plum wither-tip form were larger than those of the apple blossom-wilt form when taken from dead spurs, though the reverse obtained when they were grown in culture. In both cases sporulation increased as temperature decreased; it ceased at 30° C. and was greatest at the lowest temperature tested, viz., 6° to 9°. Between 8° and 26° the wither-tip form sporulated more freely than the blossom-wilt form.

When grown in culture on various [named] media, the wither-tip form was grey and lobed at the periphery, but the blossom-wilt form was white, and formed concentric rings.

When apple flowers were inoculated with a pure culture of the blossom-wilt form the fungus penetrated the style and pedicel and caused the entire truss to wilt, cankers later appearing on the infected branches. When, however, they were inoculated with the wither-tip form, they became detached at the base of the pedicel, whereupon the disease was arrested.

Plum flowers inoculated with the wither-tip form rapidly died; the fungus passed down the pedicel, the leaf petioles turned

brown, and the infected branches showed typical wither-tip. Plum flowers inoculated with blossom-wilt died, but the pedicels bearing them remained green and the remaining flowers developed normally.

These results are considered to justify the differentiation of the two specialized forms, *mali* and *pruni*, of *S. cinerea*.

The best control was given by removing and burning diseased spurs and trusses.

GUYOT (A. L.). **Considérations générales sur l'état sanitaire des plantations fruitières de la Vallée du Rhône.** [General considerations on the sanitary condition of fruit plantations in the Rhone valley.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 7, pp. 210–224, 1 pl., 1928.

After briefly reviewing the remarkable extension of fruit and vegetable growing in the vicinity of the Rhone valley which has followed active propaganda and encouragement by the Paris-Lyons-Mediterranean railway company, the author discusses various cultural practices likely to ensure the health of the trees, and gives brief recommendations for the control of peach leaf curl (*Exoascus* [*Taphrina*] *deformans*) and apricot blossom and twig wilt (*Monilia* [*Sclerotinia*] *cinerea*) [*R.A.M.*, vi, p. 171]. Notes are also given on the dying-off of other fruit trees accompanied by a black discoloration of the wood, the cause of which is still obscure [ibid., v, p. 304; vi, p. 426; and next abstract].

JOËSSEL (P. H.). **Quelques maladies du Pêcher et de l'Abricotier dans la région rhodanienne.** [Some diseases of Peach and Apricot in the region of the Rhone.]—*Prog. Agric. et Vitic.*, xc, 41, pp. 350–353; 42, pp. 370–374, 1928.

In this paper notes are given on the symptoms and control of leaf curl [*Taphrina deformans*] and *Coryneum* [*Clasterosporium carpophilum*] of peaches and blossom-wilt of apricots (*Monilia* [*Sclerotinia*] *cinerea*) [see preceding abstract].

The apoplexy type of wilt [ibid., vi, pp. 237, 426] of apricots is characterized by the sudden death of the branches or the entire tree, usually when the fruits ripen, but this is preceded shortly or some years before by readily distinguishable symptoms. In trees about to succumb soon, the leaves appear simultaneously with, or even before, the flowers, while brown patches are visible in the woody tissues of the trunk or main branches. Trees affected by the less rapidly fatal form of the disease show fading or chlorotic, small, reddish leaves, the edges of which curl upwards, and which may have a similar transparency to that associated with 'esca' disease of the vine [*Stereum hirsutum*: ibid., vi, p. 711]. Such trees usually throw out numerous bushy suckers resembling the 'court noué' type of growth.

A similar condition affects peaches, the preliminary symptoms appearing on trees of all ages, even nursery stock. The branches or roots show dark, gummy areas in the wood, in some of which the author found a species of *Verticillium*, to which he attributes the disease, in view of the similarity between the symptoms and those produced by this fungus on other hosts. The discoloured

areas were always associated with wounds, which, in the author's opinion, facilitate the entry of the parasite, this being followed by infection with secondary organisms, which hasten the death of the trees.

JOËSSEL (P. H.). **Le Monilia de l'Abricotier dans la moyenne Vallée du Rhône et en Provence.** [*Monilia* of the Apricot in the middle valley of the Rhone and Provence.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 7, pp. 198–209, 2 figs., 1928.

The author states that infection of apricot blossoms with subsequent spread to the twigs by *Monilia* [*Sclerotinia cinerea*: see preceding abstracts] may occur in the south of France at any time during flowering, as soon as the blossom makes its appearance from the bud; attacks are favoured by cold, wet weather.

In dry years, a single spraying given as soon as the flower buds begin to open (about 10 days before blossoming), at the base of the flowering branches, may be sufficient, but in most years this should be followed by another as soon as the blossoms open. For this purpose slightly alkaline Bordeaux mixture containing 2 per cent. copper sulphate is recommended as being less easily removed by rain than are lime-sulphur mixtures. Dead wood should be removed before applying the spray. The author considers that in view of the length of time that the mixture must remain on the tree, winter treatment is unlikely to give satisfactory control. Infection of the leafy shoots and the fruit is not important enough locally to call for preventive measures.

BENLLOCH (M.). **La 'abolladura' de las hojas del Melocotonero. Taphrina (Exoascus) deformans (Fuck.) Tul.** [The leaf curl of the Peach. *Taphrina* (*Exoascus*) *deformans* (Fuck.) Tul.] —*Bol. Pat. Veg. y Ent. Agric.*, iii, 10–11, pp. 41–44, 2 figs., 1928.

Popular notes are given on the leaf curl of peaches in Spain due to *Taphrina deformans*, which may be controlled by spraying the trees, a month before flowering, with a mixture of 2 to 3 kg. of copper sulphate, 3 to 4 kg. of finely ground slaked lime, 50 gm. of finely ground casein (or 1 l. of skim milk), and 100 l. of water [cf. *R.A.M.*, vi, p. 171].

SANSONE (F.). **Una speciale deformazione dei frutti di Mandorlo dovuta ad attacco dell' Exoascus deformans (Berk.), Fuck.** [A special deformation of Almond fruits due to attack by *Exoascus deformans* (Berk.) Fuck.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 3, pp. 291–299, 5 figs., 1928.

In May, 1928, some of the fruits of two almond trees growing near Portici showed small tumours, the affected surfaces gradually turning reddish-yellow dotted with reddish spots. Subsequently the middle of the tumour became wrinkled and exuded gum, and the tissues finally became necrosed, the endocarp and kernel being sometimes also involved.

This condition was found to be due to *Exoascus* [*Taphrina*] *deformans* [*R.A.M.*, v, p. 306], the hyphae of which penetrated deeply into the mesocarp and also reached the epidermis, but without rupturing the latter to form asci. The tumours were mainly

formed by the swelling of the individual parenchymatous cells, without increase in their numbers or change in their shape. The vascular tissues were less affected. Very few of the leaves on these trees were attacked, and the author suggests that the fruit may be infected when there is no sign of the disease elsewhere on the tree.

WORMALD (H.). **Bacterial diseases of stone-fruit trees in Britain. I. Preliminary note on bacteriosis in Plum and Cherry trees.** —*Ann. Rept. East Malling Res. Stat. 1926 and 1927, II Supplement,* pp. 121–127, 4 figs., 1928.

The author's investigations at East Malling Research Station, Kent, of three bacterial diseases of plum and cherry trees, viz., shoot wilt of plums, leaf spot and gummosis of cherries [*R.A.M.*, vii, p. 616], and canker and leaf spot of both are summarized. The first condition resembles wither-tip (*Sclerotinia cinerea*), but the lesions are larger and frequently extend for several inches along one side of the shoot. When the latter becomes girdled, the portion terminal to the lesion becomes flaccid and wilts. The condition was observed only during wet weather, on young trees producing vigorous, sappy shoots. Inoculations with cultures of a bacterium isolated from a naturally infected shoot gave markedly positive results on sappy shoots growing under moist conditions, and were occasionally successful on older branches.

Bacteria isolated from leaf spots and gummy lesions of cherry gave similar reactions in both cases under cultural tests; inoculations of opening buds with the leaf spot isolations either killed the buds, or, if they grew out, the leaves showed typical spotting. Inoculations of the branches produced elongated, copiously gummy lesions, while the control wounds healed normally.

The bacterial canker and leaf spot of plum and cherry has generally been referred to as die-back [*R.A.M.*, vi, p. 563]. It has killed many plum trees at East Malling, and the author considers that the disease [the symptoms of which are described] was due neither to faulty soil conditions nor to a weak parasite as suggested by Briton-Jones [ibid., iv, p. 741], since the trees were growing under excellent soil and other conditions. Almost invariably the diseased areas on the stem contained masses of bacteria at the upper and lower limits of the lesions. In the spring of 1926, a bacterium differing culturally from the organisms associated with the two other diseases mentioned above was isolated from stem lesions of affected plums, and ten young plum trees were inoculated with a suspension of a culture, while ten other trees, alternating with the former, were similarly wounded, but sterile water only was placed in the cuts. The control trees remained healthy, but in each inoculated tree the stem became girdled and the part of the tree above the canker died.

In the same trial plot the leaves of many otherwise healthy plum trees showed bacterial spotting and shot holes; from such spots an organism was isolated closely resembling in culture that obtained from the stem cankers. Inoculations on plum stems and branches with this leaf spot organism invariably gave positive results, sometimes followed by the death of the parts distal to the infected

areas. Similar results were obtained with isolations from spots on the fruit and young shoots.

Attempts to isolate the organism from cankers late in the season were unsuccessful, and as the latter cease to grow during the summer it is considered that the bacteria then either become inactive or die out. Meanwhile the leaves become infected, and their riddled appearance is sometimes very conspicuous. Since many affected trees are completely killed, bacterial canker is considered to be a more suitable term than die-back. The disease also attacks cherries, and inoculations of young cherry trees with an organism apparently identical with that in plum cankers, but isolated from a cherry stem, also gave positive results.

The disease is apparently widespread, as it has been reported from Kent, Evesham, and Cambridgeshire.

Trees showing stem infection with the bacterial canker should be removed, as they are not known to recover. In the shoot wilt disease the infected shoots should be removed and burned.

WORMALD (H.). **On the cause of 'die-back' in Plum trees.**—*Gard. Chron.*, lxxxiv, 4585, pp. 372–373, 5 figs., 1928.

This is a somewhat expanded account of the author's investigations into die-back or bacterial canker of plum trees, which have already been noticed from another source [see preceding abstract].

KESSLER (H.). **Der gegenwärtige Stand der Obstlagerungsfrage.** [The present status of the fruit storage question.]—*Landw. Jahrb. der Schweiz*, xlii, 2, pp. 598–642, 6 graphs, 1928.

With a view to increasing the knowledge and improving the technique of fruit storage in Switzerland, the writer describes and discusses recent developments in the control of storage diseases and other aspects of fruit preservation. Most of the investigations included in this survey have been conducted by English and American workers, but it is pointed out that the problems of fruit storage are beginning to receive attention in various countries, such as Denmark, Germany, and Russia.

HARRIS (R. V.). **The pathology of the Raspberry: a summary of results of recent research at East Malling.**—*Ann. Rept. East Malling Res. Stat. 1926 and 1927, II Supplement*, pp. 128–134, 1928.

In the blue stripe wilt of raspberry (*Verticillium dahliae*) [*R.A.M.*, vii, p. 615] the only reproductive bodies found on the canes at East Malling are the microsclerotia, so that infection by air-borne conidia does not occur; the disease always begins in the roots. It was noted that a slightly affected stool might, when transplanted, recover, and stools diseased one year were sometimes normal the next. In some varieties susceptibility varied with the locality, but Bath's Perfection, Red Antwerp B, and Prior's Prolific were very susceptible in most districts.

Applications of Bordeaux mixture and lime-sulphur for the control of cane spot (*Plectodiscella veneta*) [ibid., vii, p. 649] made

on Baumforth B raspberries each increased the crop weight by approximately 50 per cent.

Foliage mottling caused by mosaic [ibid., vi, p. 172; vii, p. 615] was in some varieties associated with dwarfing and crop failure. The disease persists from year to year, and in some varieties is apparently becoming more prevalent. The leaf symptoms vary considerably, notably in Baumforth Seedling B. Varieties differ appreciably (*a*) in the rapidity with which the initial infection spreads (this varies with the locality); (*b*) in the ultimate intensity of the leaf symptoms and the proportion of severely affected stools of a given age; and (*c*) in the degree of dwarfing and degeneration. The proportion of severely affected stools does not always provide a satisfactory standard by which varietal susceptibility can be compared. Several strains of Bath's Perfection showed no, or only slight, infection. The disease has, however, become more serious in Lloyd George canes. Red Cross, Norwich Wonder, Hornet A, Scotch Victoria, Superlative, Fastolf A, Norwich Market, and Reader's Perfection were found to be very susceptible. In several varieties mosaic was transmitted by vegetative propagation. The spread of infection through a plot of Baumforth B canes was not rapid, and normal stools planted in close proximity to diseased canes remained healthy for years. It is possible that in this variety mosaic may be controlled by systematic roguing.

In cases of spur blight [see above, p. 153] *Didymella applanata* was constantly associated with the discoloured regions of the bark tissues, near non-developing buds; inoculations with pure cultures of the fungus gave positive results. Reader's Perfection, Pyne's Royal, Superlative, and Hornet A proved very susceptible. Diseased canes should be removed in spring, and the superfluous spawn periodically hoed out during the growing season.

SMALL (W.). **Bunchy-top disease of Plantains in Ceylon.**—*Trop. Agriculturist*, lxxi, 3, pp. 141–147, 1 pl., 1928.

After a brief reference to previous investigations of the bunchy top disease of plantains in Ceylon [*R.A.M.*, i, p. 108; viii, p. 17] and elsewhere, the author describes in some detail an experiment made in 1927 at Peradeniya, in which he claims that well-defined symptoms of bunchy top were produced in two healthy plantain suckers growing in a pot in soil that had been inoculated with *Rhizoctonia bataticola* [*Macrophomina phaseoli*]. The roots of these plants were decayed, and sclerotia of *R. bataticola* were present in them. Two suckers of the same variety grown as controls in uninoculated soil remained healthy throughout the experiment, in spite of the fact that they had been heavily infested by the aphid *Pentalonia nigronervosa*, some of which had been transferred from the diseased plants.

In a recent visit to Ceylon, Magee concluded that the disease there is identical with bunchy top in Australia [ibid., vii, p. 253], but the author does not accept this conclusion. In his opinion, Ceylon bunchy top requires to be investigated *ab initio* with due attention to each possible causal factor and with repeated tests of each under controlled conditions.

Walters (E. A.). **St. Lucia's Banana industry.**—*Trop. Agriculture*, v, 10, pp. 247–249; 11, pp. 284–286, 1928.

This account of the attempted development of commercial banana planting in St. Lucia (West Indies) includes information on the work done locally in the control of Panama disease [*Fusarium cubense*], most of which has been noticed from the author's annual reports [*R.A.M.*, viii, p. 20]. The disease, of which the first three cases were seen in 1924, quite frequently appeared as scattered infections, and rarely showed extension from a central point. After a few years infection reached an intensity of 20 per cent. in some areas. A point specially mentioned is that the external symptoms, namely, yellowing of the lower leaves and, in advanced cases, the splitting of the stem and some breaking of the petiole of the lowest leaf, showed certain differences from the published accounts.

Since the cessation of the activity of the Swift Banana Company, the position of banana cultivation in St. Lucia has markedly changed for the worse, owing to the withdrawal of supervision and the non-treatment of new cases of infection. In the author's opinion there is in St. Lucia at present a sufficient amount of infective material to destroy any ordinary cultivation of the Gros Michel variety within a year or so.

Benlloch (M.). **Sobre el tratamiento del 'repilo' o caída de las hojas de los Olivos.** [On the treatment of the 'repilo' or leaf fall of Olives.]—*Bol. Pat. Veg. y Ent. Agric.*, iii, 10–11, pp. 1–8, 4 figs., 1928.

A description is given in popular terms of the leaf fall of olives in Spain caused by *Cycloconium oleaginum*, together with directions for its control by sanitary measures (e.g., the burning of diseased material, ample spacing, sparing use of nitrogenous manures, and the application of lime where necessary), combined with spring and autumn spraying with Bordeaux mixture.

Noble (R. J.). **Some observations on the woodiness or bullet disease of Passion fruit.**—*Journ. & Proc. Roy. Soc. New South Wales*, lxii, pp. 79–98, 4 pl., 1 graph, 1928.

After a full account of the history and symptoms of the bullet or woodiness disease of passion fruit (*Passiflora edulis*) [*R.A.M.*, viii, p. 115] in New South Wales, the author describes experiments in which nine healthy seedlings in an insect-proof glass-house were inoculated on 13th April, 1928, with cotton wool soaked in a watery tissue extract taken from diseased leaves and inserted through a needle wound in the vascular region of the stem. Eleven days later, all the inoculated plants showed definite infection of the developing leaves (mosaic mottling, with leaf curling and distortion), and after five weeks yellowish spots developed on the mature leaves. A further series of inoculations with diseased leaf tissue from plants in another locality also produced marked infection in 15 to 24 days. On 4th May, 1928, six healthy plants were inoculated with extract from diseased fruits, and the above-mentioned symptoms were noted on all after 20 to 27 days. Six healthy seedlings of *P. edulis* were inoculated with an extract from the leaves of *P. caerulea* which showed a mosaic-like condition

resembling that sometimes seen on *P. edulis*, and 13 to 20 days later four of the seedlings became infected. The control plants remained healthy throughout the tests.

The variations in the incubation period are attributed to fluctuating temperature, this being correlated with the fact that the disease is most serious in winter, and that plants which then produced diseased fruits may fruit normally the following summer, the symptoms becoming masked in warm weather. The paper terminates with suggestions for control [loc. cit.], and there is a bibliography of 14 titles.

GINSBURG (J. M.). **Investigations of dusts, spreaders, stickers and diluents for spraying and dusting mixtures.**—*Forty-eighth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1927*, pp. 127–133, 1 fig., 1928.

The use of ferric oxide (3 to 4 lb. per 50 galls.) as a corrective against arsenical spray injury [cf. *R.A.M.*, vii, p. 795] in the New Jersey dry-mix sulphur lime spray plus acid lead arsenate (1 lb.) and skim milk powder (½ lb.) was also found to promote adhesion of the spray in experiments both on peach and apple trees. In connexion with the use of stickers, it was found that both fish and mineral oils are liable to cause foliage injury. The data secured in preliminary experiments indicate that sperm oil and nujol (2 per cent. or below) may be used as substitutes with satisfactory results.

SARDIÑA (J. R.). **Los preparados coloidales en terapéutica vegetal.** [Colloidal preparations in plant therapeutics.]—*Bol. Pat. Veg. y Ent. Agric.*, iii, 10–11, pp. 24–30, 1928.

This is a general account of the application of colloidal preparations of sulphur, copper, &c., in the control of plant diseases. Special reference is made to the use of colloidal sulphur against *Oidium* of the vine [*Uncinula necator*: *R.A.M.*, viii, p. 85], *Microsphaera grossulariae* on gooseberries [ibid., vi, p. 337], and *Monilia* [*Sclerotinia*] *cinerea* on cherries, plums, and peaches.

Colloidal copper is stated to be now widely used against downy mildew of the vine [*Plasmopara viticola*: ibid., vi, p. 627]. Some notes on the methods employed in the preparation of colloidal substances are given.

BROOKS (F. T.). **Plant diseases.**—viii + 386 pp., 62 figs., Oxford Univ. Press, 1928.

This is the most complete account of the fungous diseases attacking crop plants in the British Isles which has yet appeared. Important diseases of crops in other parts of the Empire and in other countries of the world, however, are not neglected, and references to these add to the value of the book. The subject-matter is arranged according to the pathogen and not the crop plant, starting with bacteria and working through the various groups of fungi to the Polyporaceae, the Fungi Imperfecti occupying some 60 pages at the end. Non-parasitic and virus diseases are discussed in separate chapters at the beginning and fungicides form the subject of the concluding chapter. All the illustrations are new—an unusual feature in a book of this character. The common names

of the various British diseases are those recommended by the Plant Pathology Sub-committee of the British Mycological Society, whose official list will shortly be published. Under each heading the pathogen is briefly described and the symptoms and control of the disease noted, the text, which is necessarily condensed in a book of this size, being supplemented by the very full bibliographical references which are given at the end of each chapter. It is thirteen years since the last edition of Massee's text-book appeared and many additions to our knowledge have been made during the interval. The need for a new book was, therefore, urgent and the publication of this volume forms a welcome addition to the literature of the subject.

MEURS (A.). **Wortelrot, veroorzaakt door schimmels uit de geslachten Pythium Pringsheim en Aphanomyces De Bary.** [Root rot caused by fungi of the genera *Pythium* Pringsheim and *Aphanomyces* De Bary.]—Thesis, University of Utrecht (Hollandia-Drukkerij, Baarn), 95 pp., 5 figs., 1928. [English summary.]

After a review of previous literature on the occurrence in the soil of *Pythium*, *Phytophthora*, and *Aphanomyces* spp., the writer describes his own investigations on the rôle of these fungi in the causation of root rot [cf. *R.A.M.*, vi, p. 380].

The organisms were isolated from the roots of diseased plants growing in leaf mould at or near Baarn and cultured on oatmeal agar. The technique of the experiments is fully described, and the results are tabulated and discussed at some length. The plants used in these studies included beet, spinach, strawberry, peas, beans (*Phaseolus vulgaris*), *Lupinus polyphyllus*, tobacco, lentils (*Lens esculenta*), cucumber seed, and a number of ornamentals.

Pythium de Baryanum, *P. de Baryanum* var. *pelargonii*, *P. intermedium*, *P. irregulare*, and *P. splendens* were the organisms most frequently isolated (in 19, 30, 29, 27, and 20 cases, respectively). *P. de Baryanum* was found on diseased roots of beets, beans, lentils, spinach, and *Gloxinia*. Its var. *pelargonii* [ibid., v, p. 35] occurred in such a large proportion of the rotted roots of various plants examined that it is evidently a very common soil fungus. *P. intermedium* [ibid., vi, p. 380] was isolated from peas, beans, strawberries, *Aquilegia vulgaris*, pansies (*Viola tricolor*), *Arabis alpina*, and other flowers. *P. irregulare* [ibid., vi, p. 381] was often encountered on peas, beans, lentils, and pansies, and less often on various flowers and on Chinese mustard [*Brassica juncea*]. *P. splendens* [ibid., vi, p. 35] was found only on tobacco, in rotted roots of which it was common. *P. artotrogus* (on spinach and *Arabis alpina*), *Phytophthora cactorum* (on *Godetia* and *Eschscholtzia*), and a physiological form of *Aphanomyces euteiches*, isolated from spinach, pansies, and *Arabis*, were less often met with under the conditions of these experiments. The Dutch form of *A. euteiches* differs from the original American strain in certain cultural characters, and also in its markedly slighter pathogenic action. The designation P.F. 2 is proposed to differentiate the Dutch form from the American (P.F. 1).

From damped-off sugar beet seedlings on clay soil the author

isolated a species of *Pythium* differing from those hitherto described in the occurrence of obtuse, often curved protuberances, measuring 2·7 to 6 μ (average 4·4 μ), on the oogonia. The fungus is named *P. mamillatum* n. sp., with technical diagnoses in Dutch and English. The hyphae are 4 to 9·3 μ in diameter (average 5·9 μ). The oogonia are globose, and measure 20·3 to 29·3 μ in diameter (average 24·5 μ including the protuberances or 16·4 μ without them) being completely filled by the oospore whose brownish wall, from 1 to 1·3 μ thick, can scarcely be separated from that of the oogonium. A clavate antheridium arises from the oogonial hypha. The zoosporangia are globose, measure 14·3 to 20·7 μ in diameter (average 16·3 μ), and contain five to fourteen reniform zoospores. The fungus was shown by experiments to be capable of causing damping-off in beet seedlings. *P. mamillatum* is placed in the subgenus *Sphaerosporangium*, close to *P. megalacanthum*, *P. artotrogus*, and *P. irregulare*.

Phytophthora cactorum was isolated from diseased *Godetia willdenowiana* and *Eschscholtzia californica* plants, and the unpublished data of a biometrical comparison showed that the strain from these hosts is identical with one isolated by Miss Birnie some years ago from a rotting hazel-nut.

The results of inoculation experiments on peas with the Dutch and American strains of *A. euteiches*, *Pythium irregulare*, *P. de Baryanum*, *P. de Baryanum* var. *pelargonii*, and *P. intermedium* are fully described. Next to *A. euteiches* P.F. 1, *P. irregulare* was the most virulent parasite, causing an extensive dark or reddish-brown discoloration and decay of the root system. The attacks of this organism were much more severe at P_H 5·4 than at P_H 8. *P. de Baryanum* and its variety also caused infection of peas both in acid and alkaline media, whereas *P. intermedium* and *A. euteiches* P.F. 2 were not pathogenic on this host.

P. irregulare caused a root rot of beans characterized by very similar symptoms to those produced in peas. Here again infection was more severe at P_H 5·4 than at P_H 8.

A. euteiches P.F. 2 causes a severe root rot of pansies in Holland, while the American strain is absolutely non-pathogenic to this host.

DUFRÉNOY (J.). **Introduction à l'étude cytologique des plantes affectées par des maladies à virus.** [An introduction to the cytological study of plants affected by virus diseases.]—*Ann. des Épiphyties*, xiv, 2, pp. 163–174, 7 pl., 1 fig., 1928.

An account is given of the author's cytological studies [the technique of which is indicated] of 15 species of plants affected with virus diseases. Briefly summarized, the conclusions reached are as follows.

The lipoid-proteid complex of the plastids in cells of mosaic tissues becomes dissociated, and the proteid elements may break up until the whole plastid gives lipoidal reactions. The plastids also show a tendency to vesicular degeneration [*R.A.M.*, vii, p. 735]. In leaf buds on infected plants a considerable number of the mitochondria develop into amyloplasts, but chloroplasts are formed in relatively small numbers, and do not reach the normal size. Certain of the mitochondria undergo a vesicular degeneration such as has

been stated to occur when they are exposed to the action of a hypotonic solution. Cells of affected tissues become plasmolysed by solutions that are isotonic to healthy cells. The sap in affected cells appears to be less acid than that in healthy ones. The commonest effect on the vacuolar system is the fragmentation of the vacuoles in a part of the cell where the cytoplasm becomes extremely sensitive to colouring agents; these readily staining areas appear to correspond with areas of proteolysis, where the vacuoles tend to become linear, and the appearance suggests the so-called 'apparatus of Golgi'.

The modifications observed in these investigations affected only the normal cellular structure, and were such as could be produced by simple physico-chemical agents; they were analogous with the reactions caused by known parasites, and in no way specific to virus diseases.

McKinney (H. H.). **Further studies in quantitative virological methods.**—*Science*, N.S., lxviii, 1764, pp. 380–382, 1928.

Preliminary studies on the virus of light green tobacco mosaic indicated that discrepancies in quantitative tests and variations in the initial virus concentration in fresh extracts are caused by several factors [*R.A.M.*, vii, p. 45]. The relative importance of some of these factors is now being determined.

Quantitative inoculation tests have been made in full daylight at low (55° to 60° F.) and fairly high temperatures (77° to 85°), in reduced daylight, and in artificial light. The results of these experiments indicate that the number of plants that developed mosaic was influenced less by light and temperature than by the amount of inoculum and the location and nature of the incision.

The time required for the first signs of mosaic is prolonged and irregular in experiments made at low temperatures and in hazy weather. Leaf mottling is less conspicuous, and considerable deformation frequently occurs when the light intensity is low.

Inoculations by means of needle incisions have been found less effective when made in the leaf lamina than in the midrib. Breaking the trichomes on uniform areas of the leaves with a brush dipped in the inoculum produces a higher percentage of infection than do needle pricks in the lamina. Uniform leaf areas can be delimited by means of a wire ring. The leaf is held between this ring and a flat metal disk, and the encircled area brushed uniformly with the virus extract so as to break the trichomes without injuring the epidermis.

When testing extracts known to be of low virus concentration, the plants are inoculated by the needle-cotton method previously described when the tenth leaf is 2·5 to 5 cm. long, or younger plants are inoculated by the above ring-brush method. When testing extracts known to be of fairly high concentration, the plants are inoculated when the largest leaf is 2·5 to 3 cm. long by puncturing the midrib or lamina with needles dipped into the extract [ibid., vii, p. 477]. This mode of procedure is rapid, but the needles may carry a variable amount of the infective fluid. No such variations occur in the quantities of extract carried on the

cotton in the needle-cotton method, which is considered to be as accurate as any yet devised for mosaic transmission.

The following method of extracting the virus has been found satisfactory in the author's tests. Small representative samples of tissues are weighed, pulped in a stoneware mortar, with the addition of sufficient sterile distilled water to make a very soft pulp; on completion of this process water is added to bring the volume in cubic centimetres up to 30 or more times the original weight in grammes of the tissue samples. Extraneous materials are removed from the extract by means of a laboratory centrifuge.

DOAK (K. D.). **Mycorrhiza-bearing species in the vicinity of Lafayette, Indiana.**—*Proc. Indiana Acad. Sci.*, xxxvii (*1927*), pp. 427–439, 5 figs., 1928. [Received January, 1929.]

Notes are given on the mycorrhiza occurring on a number of trees and a few other plants in Indiana. In the case of *Fagus* and *Quercus* there are indications that several fungi may be involved. An incompletely formed mantle frequently found on the roots of *Cercis canadensis* shows that the growth rate of the fungus may be a determining factor in mantle development. The ectotrophic forms of mycorrhiza generally found on forest trees [see next abstract] are favoured by the presence of leaf mould or other surface organic deposits in the soil. This applies in particular to those occurring on *Quercus* spp.

McDOUGALL (W. B.) & LIEBTAG (CHARLOTTE). **Symbiosis in a deciduous forest. III. Mycorhizal relations.**—*Bot. Gaz.*, lxxxvi, 2, pp. 226–234, 1928.

In an examination of 145 species of seed plants belonging to 114 genera and 60 families, near Urbana, Illinois, mycorrhizal fungi were found in 93 species, 76 genera, and 43 families [which are enumerated: cf. *R.A.M.*, vii, p. 387]. Only eight of the species (all trees) possessed ectotrophic mycorrhiza, the remainder being endotrophic; *Carya cordiformis* showed both types. Nearly all the endophytic fungi observed in this study appear to belong to the Phycomycetes. No evidence was obtained of any benefit accruing to the higher plants from the presence of mycorrhizal fungi.

STEVENS (F. L.). **Effects of ultra-violet radiation on various fungi.**—*Bot. Gaz.*, lxxxvi, 2, pp. 210–225, 11 figs., 1 diag., 1928.

In this paper the author gives further details of experiments on the effect of ultra-violet radiation on various fungi, a preliminary notice of which has already appeared [*R.A.M.*, vii, p. 660].

Four- to seven-day-old Difco cornmeal agar plate cultures from single conidia were placed, without covers, 21 cm. from a Cooper-Hewitt quartz mercury arc. Portions of the colony (usually one-half) were shaded from the light by a shield of hard rubber.

It was found that the minimum lethal dosage for exposed spores of *Glomerella cingulata* (isolated from apple) lies somewhat above 10 but under 15 seconds, while for spores covered by an agar layer about 1·5 mm. deep the lethal period is over 90 seconds. Marked

colony stunting resulted from 5 seconds' exposure, and slight stunting after 2 to 4 seconds. Direct radiation in mild dosage (0·25 to 4 seconds) caused the development of surface perithecia, while a dosage of 5 seconds to 2 minutes induced the formation of buried perithecia. Mature asci and ascopores are developed in four days. Normally perithecia were not formed in monosporous cultures of this strain not exposed to radiation, except sparingly in very old cultures. Perithecial production was not induced by ultra-violet rays on a medium of plain agar or on cornmeal agar of less than 50 per cent. strength. No evidence was obtained that the perithecial production induced by radiation is associated with chemical changes in the medium. The effects of radiation are local and apparently not hereditary. The efficient rays, as determined by radiation through vitaglass, a blue-purple glass known as corex, and the Hilger quartz spectograph E2, were found to lie throughout the region of the ultra-violet wave-lengths shorter than 313 m μ.

Eight-day-old colonies of a species of *Coniothyrium*, normally forming pycnidia only when very old, were irradiated for periods ranging from 1 second to 3 minutes. With 1 second there was very slight stunting, which became distinct at 5 seconds. With 10 seconds numerous superficial or buried pycnidia were formed, while a few were also scattered through a zone of mycelium that was one to two days old when radiated. With increasing periods of exposure (up to 3 minutes) the pycnidia became more numerous in the older zones, where the mycelium was extensively destroyed.

It seems possible that the effects described above may be due to a stimulus acting either on the protoplasm or the nuclei; or they may depend on the production or destruction of some intracellular substance directly and specifically affecting cell activity. On the other hand, the phenomenon may be an expression of the law that a well-nourished organism, suddenly inhibited in growth, turns to reproduction.

MOHENDRA (K. R.). **A study of the changes undergone by certain fungi in artificial culture.**—*Ann. of Botany*, xlii, 168, pp. 863–889, 3 pl., 2 figs., 1928.

A detailed account is given of the cultural behaviour under different conditions of *Neocosmospora vasinfecta*, two unidentified species of *Phoma*, termed A and B, and *Alternaria tenuis* on various media, parallel lines of transfers being set up (*a*) with young mycelium only, (*b*) old mycelium only, and (*c*) spores only, and these series being carried through numerous generations.

Saltation took place from time to time in all four organisms, and details are given of the origin and characters of the saltants obtained. It was found that each original strain remained constant in at least a part of its growth under the different methods of cultivation adopted, so long as care was taken to avoid subculturing from a saltating part. A noteworthy feature of *N. vasinfecta* was the sudden loss in the saltant strain of the capacity to form perithecia. The strains of the two *Phoma* species varied in the presence or absence of necks to the pycnidia. With the strains of *Phoma* B, exclusion of light reduced pycnidial formation, while

the reduction of its intensity increased the size of the pycnidia and tended to produce sterility. *A. tenuis* gave rise to numerous saltants (one of which subsequently gave a definite reversion to the parent form), and contained one strain which regularly showed saltation.

Barnes (B.). **Variations in Eurotium herbariorum (Wigg.) Link. induced by the action of high temperatures.**—*Ann. of Botany*, xlii, 168, pp. 783–812, 1 col. pl., 4 figs., 1928.

In 1926, two abnormal colonies appeared in cultures of a strain of *Eurotium herbariorum* which had remained constant for five years, and as there was reason to suppose that they had arisen from accidentally heated spores, experiments [which are described and the results of which are fully discussed] were conducted to ascertain whether variation could be caused by heating the spores before sowing, 242 plate cultures being made from heated spores. In 134 of these, 292 abnormal and 644 normal colonies were obtained; in the remaining 108 cultures, 58 gave some (the exact number was not determined) aberrant forms and 38 showed no growth. Variations were not observed in 43 control cultures comprising some 2,000 colonies. Series of cultures were made from the two original abnormal colonies and from some of the variants obtained from heated spores. The new forms tended to maintain their characters when grown exclusively on prune agar, but some showed variation after growth on a synthetic medium. The variants which differed greatly from normal were less sensitive to change of medium than were those which differed less, while the stock strain did not react to change of medium. The available evidence is considered to support the view that the variant forms arose as a result of heating the spores.

Zeliff (C. C.). **Studies of the effects of certain organic and inorganic acids on Sclerotinia sclerotiorum.**—*Trans. Amer. Microscop. Soc.*, xlvii, 4, pp. 468–473, 1 graph, 1928.

Sclerotinia sclerotiorum, isolated from market lettuce [*R.A.M.*, v, p. 269], was grown on a modified Richards's solution adjusted to a series of hydrogen-ion concentrations from P_H 1 to P_H 10. The optimum hydrogen-ion concentration for the development of the fungus was found to be P_H 3·2.

In tests of the action of different acids, it was found that in hydrochloric acid there was no growth at acidities greater than P_H 1·7, the maximum development occurring between P_H 3 and 6. When the medium was brought to the alkaline side with sodium hydroxide, at P_H 9 and 10, the mycelium was cottony and rose considerably above the surface of the solution. The old cultures with original P_H values of 6 and 10 changed to P_H 3 and 3·3, respectively.

With phosphoric acid the best growth was made between P_H 3·5 and 3·9. Sclerotia in these solutions were formed on the fifth day, i.e., one day earlier than in hydrochloric acid. No development occurred where the acidity was greater than P_H 1·5.

Growth in citric acid is of special interest in view of the cottony rot of lemons caused by *S. sclerotiorum* [ibid., vii, p. 163]. The

hydrogen-ion concentration of the lemon is between P_H 2 and 3, coinciding with the maximum development of the fungus in citric acid. Similar relations were observed with oxalic acid.

Growth in lactic acid was not vigorous and ceased at P_H 2·3.

The inhibition of growth in cultures of *S. sclerotiorum* by the addition of acids is considered to be probably due to the combined effect of the anion and the undissociated part of the molecule in addition to the hydrogen ions.

BORDAS (J.) & JOËSSEL (P. H.). **Sur l'action réductrice exercée par des champignons des genres Fusarium et Verticillium, parasites des vaisseaux du bois.** [Note on the reducing action of species of *Fusarium* and *Verticillium*, vascular parasites of wood.]—*Comptes rendus Acad. des Sciences*, clxxxvii, 14, pp. 574–576, 1928.

The fact that, when cultured on Richards's agar to which a drop of 0·125 per cent. solution of methylene blue per 5 c.c. of the medium had been added, *Fusarium vasinfectum*, *F. eumartii*, *Verticillium albo-atrum*, *V. dahliae*, *V. lycopersici*, and an unidentified species of *Verticillium* from a chlorotic peach tree imparted a green discoloration to the culture medium within a few days of growth, leads the authors to consider that these fungi exert a very energetic reducing action on their substratum. It is pointed out that all these organisms are vascular parasites which, besides producing rapidly perceptible lesions in their hosts by the obliteration of the lumina of the wood vessels with tyloses and gum substances, appear capable of wilting the leaves at a distance by the secretion of toxic substances, some of which, it has been suggested, may be nitrites formed by the reduction of nitrates in the sap. Tested under similar conditions *Polyporus fulvus* and *Stereum hirsutum* var. *necator* reacted much more slowly on the culture medium, to which they imparted a lilac discoloration. *Schizophyllum commune* did not discolour the substratum.

WALLACE (R. H.). **Histogenesis of intumescences in the Apple induced by ethylene gas.**—*Amer. Journ. of Botany*, xv, 9, pp. 509–524, 2 pl., 1928.

Continuing his histological and cytological studies on the intumescences developing in the buds and stems of Transparent apples in response to stimulation by ethylene gas [*R.A.M.*, vii, p. 34], the writer found that such swellings arise through three fundamental changes in the affected tissues, viz., solution of the walls and hypertrophy and proliferation of the cells.

The dissolution or digestion of the cell walls, which results in a more or less complete separation of the cells from tissue continuity, and in the rounding-up of the individual protoplasts, consists chiefly in the solution of the secondary thickening, the protoplast eventually being surrounded only by the very delicate tertiary membrane of the wall. The middle lamella appears to be destroyed immediately before or at the time of the final dissolution of the secondary wall thickenings. All the living elements between the phellogen and the true cambium may undergo this corrosion of the walls and liberation of the cells. Even the walls of the bast fibres

and at times some of those of young xylem vessels may similarly be dissolved. The marked cell enlargement of later stages seems to follow the partial liberation of the cells, except in the phellogen, where there is great radial hypertrophy of the cells without corrosion of the walls. The superficial blister-like swellings are largely the result of this hypertrophy of the cork-cambium. The sieve-tubes do not enlarge appreciably and may often be found in young intumescences in an apparently unchanged condition free among the other cells. The cells of the true cambium are also not enlarged.

Proliferation of the cells of any of the living tissues of the bark may occur during the formation of intumescences. These cell divisions in the intumescence itself are scattered and are not concerned in the development of the protective cork layer. Only rarely do two or more adjacent cells undergo simultaneous division. The increase in the cell number accompanying the formation of intumescences in the end of cuttings was estimated at 33 per cent. Only the cork cells remain in tissue continuity when the intumescences in the stems and buds have reached maturity. The living tissues disintegrate into a friable mass of living, unspecialized, rounded cells which have lost all their normal structural and physiological connexions.

A protective cork layer is regularly found along the inner margins of an intumescence and separates it from the underlying normal tissue. This may be considered as a typical wound response for apple, since an almost exactly similar layer often forms in the cut ends of twigs in conditions unfavourable to callus production. The cork layer is formed by one or more divisions in one or several layers of cells lying along the inner margin of the area undergoing the above-mentioned changes. The oldest cells of the collenchyma may participate in its formation, so that the new cork finally connects with the original cork of the stem. The position of the cork layer is determined within a few days after exposure to the gas, and it generally extends more or less transversely across the bark from the phellogen to the true cambium. It is clear that this corky layer actually prevents the unlimited spread of tissue disorganization.

DUCOMET (V.). **La filosité de la Pomme de terre, maladie à crises.** [Filosité of the Potato, an intermittent disease.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 7, pp. 184–185, 1 diag., 1928.

Continuing his investigations into filosité of the potato [*R.A.M.*, vi, p. 435] the author in 1925 planted out 15 tubers of Triumph 1924 potatoes in groups, according to the degree to which they were affected; 2 were free from the disease, 2 were slightly affected, 4 showed semi-, and 7 complete, filosité. Next year, the progeny of two of the totally diseased tubers showed, respectively, slight and semi-filosité. Otherwise, the disease did not appear. In 1927, however, the disease was as general as it had been in 1924. The progeny of 6 clumps descended from the tubers which had been completely affected in 1925 showed complete filosité, though only one of their mother clumps had shown slight

infection in 1926. There was slight filosité both in the progeny of a clump descended from a tuber which had been slightly affected in 1925, and in that of a tuber which, though itself uninfected in 1925, had then diseased sister tubers. The progeny of the remaining seven clumps showed semi-filosité. As the disease appears to occur in spasmodic crises, roguing should be carefully carried out on tubers sprouted in semi-obscurity.

BRIERLEY (P.). **Pathogenicity of Bacillus mesentericus, B. aroideae, B. carotovorus, and B. phytophthorus to Potato tubers.** —*Phytopath.*, xviii, 10, pp. 819–838, 4 pl., 1 fig., 1928.

The author isolated *Bacillus mesentericus* from rotting stored potatoes and found it to be capable of rotting tubers inoculated by needle pricks. Comparative tests were also made with *B. atrosepticus, B. carotovorus,* and *B. aroideae* [*R.A.M.*, v, p. 407; vii, p. 229].

The minimum, optimum, and maximum temperatures for development of the four organisms were: *B. atrosepticus,* 2°, 28° to 32°, and 34·5° C.; *B. carotovorus,* 2°, 28° to 34°, and 37°; *B. aroideae*, 5·5°, 28° to 37°, and 39°; and *B. mesentericus*, 8°, 39° to 42°, and 49°. *B. atrosepticus* and *B. carotovorus* caused a definite rot at all temperatures tested (the latter being weakly parasitic except between 21° and 29°); *B. aroideae* caused a mere trace of decay at 8° and well-marked infection at higher temperatures, especially above 20°; while *B. mesentericus* was harmless at 8°, barely developed at 12° and 15·5°, and was virulent above 23°. It is apparent from these data that *B. aroideae* and *B. mesentericus* may cause serious damage to tubers becoming heated in transit or in poor storage; the former may also be found virulent under field conditions. *B. carotovorus* and *B. atrosepticus,* on the other hand, can damage potatoes in cold storage.

In a series of experiments to test the effect of moisture on the progress of these rots, four controlled humidities at 12° (55, 67, 74, and 87 per cent.) and four at 22° (78, 82, 90, and 94 per cent.) were utilized. *B. carotovorus* produced negligible infection throughout; *B. aroideae* and *B. mesentericus* caused little decay at 12° but were active at 22°. *B. atrosepticus* was the most consistently active pathogen throughout, being vigorous at the lowest humidity employed at 12°. There was a general tendency towards diminished penetration with lower humidities in all four organisms.

The results of a series of varietal reaction tests showed that, of the ten sorts used, McCormick was the most resistant, while Spaulding Rose was only susceptible to *B. atrosepticus* rot. Rural New Yorker and Russet Rural, followed by Irish Cobbler, were most susceptible to all four types of decay.

In a series of experiments to test the pathogenicity of the tuber rot bacteria towards other hosts, *B. mesentericus* proved uniformly negative on all plants except potato, of which it only attacked the tubers, and in one doubtful case the stem. Carrot and turnip roots, cabbage heads and stems, *Iris versicolor* (rootstock and leaves), potato and bean stems, and *Pelargonium zonale* were infected by *B. carotovorus, B. aroideae,* and *B. atrosepticus*; tomato stems by *B. aroideae* and *B. atrosepticus*; and cucumber stems and *Zante-*

deschia aethiopica petioles by *B. aroideae* [ibid., iv, p. 608; vi, p. 466].

MÜLLER (K. O.). **Über die Züchtung krautfäuleresistenter Kartoffelsorten. (Vorläufige Mitteilung.)** [On the breeding of Potato varieties resistant to late blight. (Preliminary note.)]—*Zeitschr. für Pflanzenzüchtung*, xiii, 3, pp. 143–156, 2 figs., 1 diag., 1 graph, 1928.

Vowinckel's and the author's previous investigations showed that certain crosses between South American wild strains and cultivated potato varieties possess a high degree of resistance to late blight (*Phytophthora infestans*) [*R.A.M.*, vi, p. 47; vii, p. 665]. In view of the heavy annual losses caused by this disease in Germany (amounting to at least M. 250,000,000 in 1926), a further study has been carried out to ascertain the possibilities of developing these hybrids (herein referred to as W strains) on a commercial scale.

An investigation of over 700 German, English, American, French, Polish, Swedish, Argentinian, and Japanese varieties failed to disclose the presence of a single resistant cultivated strain of *Solanum tuberosum*. It was observed, however, that the period of most ready infection by the fungus coincides with the climax of development in the plant and that the varying reaction of early and late cultivated varieties to late blight is due to their different times of maturity, rather than to any inherent predisposition towards resistance or susceptibility. It is further apparent from these observations that one of the most important aims of selection should be to secure a retardation of 8 to 14 days in the time of reaching maturity.

In a test to determine the behaviour of 115 resistant and susceptible hybrids between wild and cultivated varieties exposed to natural infection by *P. infestans*, even the most precocious individuals were attacked at a much later stage than the early cultivated varieties. However, the fact that the W strains were found to be capable of contracting infection at an early phase of development indicates that resistance to late blight is not an absolutely stable character, but is subject to modifications through the action of external factors.

It was shown by a comparative experiment with the W strains and susceptible cultivated varieties (early and late) that maturity was reached at approximately the same dates by both groups, thereby proving that the resistance of the former is a natural character and not merely an effect of later development.

In 1926 the average yield of the W strains was more than double that of the susceptible cultivated varieties, whereas in 1927 the production of the former fell slightly below that of the commercial group. It is evident, therefore, that the breeding of W strains would be a valuable means of increasing the yields in years of *Phytophthora* epidemics such as 1926.

Resistance to *P. infestans* has been found to behave as a dominant character in the author's genetical researches. In crosses between a susceptible cultivated variety, e.g., Deodara or Gratiola, and a resistant heterozygote (232/24), some 50 per cent. of the progeny

are resistant. These data indicate that resistance to late blight is very probably based on a single genetical factor. The dominance of resistance greatly simplifies the work of breeding, since a certain number of resistant progeny must necessarily arise from every cross between a resistant and a susceptible strain. It has further been shown that the W strains are resistant to all the biological forms of *P. infestans* tested from various parts of Germany.

One of the principal aims of potato breeders must be the combination of desirable qualities of shape, colour, and the like, with resistance to late blight: the author's experiments have shown that this object is easy of attainment in a comparatively short time. The task of selection is still further facilitated by the fact that resistance to late blight is readily discernible in very young seedlings (when the second and third leaves are developed). Inoculation at this stage destroys susceptible individuals, leaving the survivors for further trials in the field.

KURIBAYASHI (K.). **Studies on overwintering, primary infection and control of Rice blast fungus, Piricularia oryzae.**—*Ann. Phytopath. Soc. Japan*, ii, 2, pp. 99–117, 1928. [Japanese, with English summary.]

The results of investigations on the mode of hibernation of the rice blast fungus (*Piricularia oryzae*) [*R.A.M.*, viii, p. 124] showed that it is effected by conidia and by overwintered mycelium in the tissues of diseased spots. It was found that conidia from the host plant retained their viability for over a year at room temperature under dry conditions, while those overwintered on soil or in farmyard manure only remained alive until the spring. The mycelium in diseased nodes retained its viability for nearly three years under dry conditions, whereas in a damp atmosphere it ceased to grow in the spring of the next year. Profuse conidial formation occurs from the overwintered mycelium in damp conditions at 18° to 30° C.

Healthy rice plants are liable to infection by overwintering conidia as well as by those formed on the mycelium in diseased plant débris under moist conditions. The conidia from the surface of apparently healthy seeds of diseased plants are capable of infecting the tissues of partially blasted seeds, which later gave rise to wilted seedlings.

Heavily infected straw should be burnt or mixed with farmyard manure and fodder. The hot water treatment is recommended for the control of the fungus on the seed.

SETO (F.). **Studies on the 'bakanae' disease of the Rice plant. I. A consideration of the occurrence of the 'bakanae' disease and the 'bakanae' phenomenon.**—*Ann. Phytopath. Soc. Japan*, ii, 2, pp. 118–139, 2 figs., 1928. [Japanese, with English summary.]

This is an amplified account of the author's investigations on the 'bakanae-byô' disease of rice in Japan, which has been proved to be caused by a species of *Fusarium* [*R.A.M.*, vii, p. 668]. Inoculations showed that the fungus does not in any way check the growth

of rice seedlings, but on the contrary stimulates them to abnormal development.

ERDMAN (L. W.). **The number of microorganisms in Carrington loam as influenced by different soil treatments.**—*Iowa Agric. Exper. Stat. Res. Bull.* 109, pp. 233–258, 4 graphs, 1928.

This bulletin presents the results of studies made from 1924 to 1926, inclusive, on the soils of a number of field plots located on Carrington loam at the Iowa Agricultural Experiment Station. These plots have been under definite soil treatments and cropping systems for 12 years. It was found that the greatest numbers of fungi occurred in November, 1924; this was followed by a gradual decrease during the winter, reaching a minimum in June, 1925. Another maximum was attained in January, 1926, and succeeded by a decrease, with a minimum in April. Applications of manure, with or without lime, failed to affect the numbers of fungi in this soil, but superphosphate and rock phosphate, combined with lime and manure, caused a slight increase.

JUEL (O.). **Två sällsynta parasitsvampar.** [Two rare parasitic fungi.]—*Svensk Bot. Tidskr.*, xxii, 3, pp. 478–480, 2 figs., 1928.

In July, 1927, wild hops near Båstad (Sweden) were found to be attacked by *Pseudoperonospora humuli* [the origin and taxonomy of which are very briefly discussed: *R.A.M.*, vi, p. 119]. Attention is drawn to the close resemblance between *P. humuli* and *P. cannabina*, the chief difference being the more profusely ramified conidiophores in the former species.

The smut *Melanotaenium endogenum* was found causing a black discoloration of *Galium verum* in Bohuslän.

STEINMANN (A.). **Verslag van den Mycoloog.** [Report of the Mycologist.]—*Meded. Proefstat. voor Thee*, c (*Versl. 1926–1927*), pp. 22–23, 1928.

Most of the mycological work from this station has already been noticed from other sources. Nutmeg [*Myristica fragrans*] fruits in Salatiga (Java) were attacked by *Cercospora myristicae*. Cultural studies of the fungus and experiments on its control by spraying are in progress.

FAWCETT (G. L.). **El enrojecimiento de las hojas de algunas variedades de Caña de Azúcar.** [The reddening of the leaves of certain Sugar-Cane varieties.]—*Rev. Indust. y Agric. de Tucumán*, xix, 3–4, pp. 104–105, 1928.

The writer considers that no importance need be attached to the reddish-purple discoloration which developed on the leaves of certain cane varieties, e. g., P.O.J. 2725 and 2714, at the time of the 1928 harvest. An examination of the affected foliage showed that the epidermal cells contain a reddish-purple liquid apparently identical with that normally found in the P.O.J. 213 and Morada de San Pedro varieties, which are characterized by reddish-purple

leaves. The phenomenon is believed to be due to the combined effects of exposure to light and low temperatures.

DODDS (H. H.). **Natal Sugar Experiment Station, Mount Edgecombe. Notes on Sugar Cane variety selection work.**—*South African Sugar Journ.*, xii, 10, pp. 627–629, 1 fig., 1928.

Among the strains and varieties of sugar-cane giving promising results in preliminary trials for mosaic resistance at the Natal Sugar Experiment Station [*R.A.M.*, viii, p. 65] are P.O.J. 2714, 2725, and 2878. A single healthy stool of P.O.J. 213 from a very heavily infected field has produced almost entirely sound progeny. It is hoped that this semi-immunity will be permanent, the more so as P.O.J. 213 is also highly resistant to streak and possesses various other desirable qualities. Several unidentified varieties from local sources, as well as those provisionally known as Townsend's Selection and La Mercy Yellow, are considered worthy of further testing. Of the Uba crosses, C.H. 64/21 (a cross with D. 74 from Cuba) is doing well; U.D. 1 (Uba × D. 1135 from Hawaii) has not inherited the resistance of Uba. The imported Indian varieties Co. 214, 213, 281, and 290 are stated to be flourishing under Natal conditions.

CABALLERO (A.). **Adiciones a la micoflora española.** [Additions to the Spanish mycological flora.]—*Bol. R. Soc. Española Hist. Nat.*, xxviii, 8, pp. 421–430, 4 figs., 1928.

The following species, *inter alia*, are of interest in this paper. *Tuburcinia kmetiana* Liro is abundant in the El Pardo mountains on the ovaries of *Viola tricolor*, this being the first record for Spain. *Melampsora castellana* n. sp., found in several localities forming yellow spots on *Populus alba* leaves, is characterized by amphigenous uredosori bounded by a white ring of hyaline, clavate paraphyses measuring 40 to 120 by 6 to 30 μ; globose, ellipsoid, ovate, rarely angular uredospores, 16 to 25 by 13 to 19 μ, with a hyaline, warty wall, intermingled with which are shorter, frequently branched paraphyses, and hypophyllous prismatic teleutospores with rounded apices, 30 to 49 by 9 to 16 μ. This species differs from *M. magnusiana* G. Wagner in its amphigenous uredosori, and from all other species of this genus on poplar in the dimensions and arrangement of the paraphyses. *Ascochyta pisi* is prevalent on the pods of *Vicia faba*. *Septoria cannabis* was found on the leaves of a new host, *Urtica dioica*. *Stagonospora zubiae* n. sp., found forming scattered, circular or irregular, dark spots with white centres on living leaves of *Acer pseudoplatanus*, is characterized by a small number of globular or ellipsoidal pycnidia measuring 80 to 97 by 60 to 80 μ, and by hyaline, cylindrical, triseptate, pluriguttulate, straight or slightly curved spores, 32 to 50 by 2 to 3·5 μ.

SAWADA (K.). **Descriptive catalogue of the Formosan fungi. Part IV.**—*Rept. Dept. Agric. Res. Inst. Formosa*, 35, 162 pp., 4 pl., 1928. [Japanese.]

This paper comprises 148 additions to the author's catalogue of

Formosan fungi [*R.A.M.*, vii, p. 273]. The descriptions are in Japanese, but the names of the fungi and hosts, some of the literature references, and the indices are in English.

GONZÁLEZ FRAGOSO (R.) & CIFERRI (R.). **Hongos parásitos y saprofitos de la República Dominicana (16ª serie).** [Parasitic and saprophytic fungi of the Dominican Republic (16th series).]—*Bol. R. Soc. Española Hist. Nat.*, xxviii, 7, pp. 377–388, 1928.

The following references are of interest in this continuation of the authors' descriptions of Dominican fungi [*R.A.M.*, vii, p. 673]. A species of *Nematospora* found on cotton (probably *Gossypium hirsutum*) seeds at Haina (Dominican Republic) was identified as *N. gossypii*. On various standard media, however, there was a sparse development of the yeast forms associated with *N. coryli* in addition to the normal mycelial mode of growth. Following up Guilliermond's suggestion for the exclusion of *N. gossypii* from genus *Nematospora* on cytological grounds and its transference to the Hemiascaceae [*R.A.M.*, vii, p. 347], the authors here create a new genus *Ashbia* [a Latin diagnosis of which is given] with the type species *A. gossypii* [this genus has been anticipated by Guilliermond's *Ashbya* founded on the same species: see next abstract].

Irenopsis coronata was found on withered leaves of *Anacardium occidentalis* near Moca. *Microthyrium mangiferae* Bonn. et Rouss., stated to be a rare species, was found on withered mango leaves in association with *Lophodermium mangiferae* and *Pestalozzia guepini*. *Aschersonia lichenoides* P. Henn. occurred in conjunction with various fungi on spotted mango leaves. *Ascochytella cupaniae* n. sp. forms large, white spots with wavy, reddish borders, and kills the leaves of *Cupania* [*Blighia*] *sapida*; it is characterized by black, erumpent, amphigenous, globular or irregular pycnidia, 120 to 150 μ in diameter, and by hyaline to pale yellow, cylindrical or fusoid, uniseptate, uniguttulate spores measuring 3·5 to 6 by 1·2 to 1·5 μ. *Leptostroma garciniae* n. sp. produces irregular, reddish or chestnut-coloured lesions, 5 to 10 mm. in diameter, with reddish or black borders, on the leaves of *Garcinia mangifera* [presumably *G. mangostana* is intended]; the globose-applanate pycnidia measure 90 to 125 μ in length and the spores are hyaline, oblong or subfusoid, tapering, guttulate, and measure 4·5 to 5·5 by 1·3 to 1·5 μ. *Cercospora sesami* Zimm. was found on living leaves of *Sesamum orientale*.

GUILLIERMOND (A.). **Recherches sur quelques Ascomycètes inférieurs isolés de la stigmatomycose des graines de Cotonnier. Essai sur la phylogénie des Ascomycètes.** [Researches on some lower Ascomycetes isolated from stigmatomycosis of Cotton seeds. An essay on the phylogeny of the Ascomycetes.] *Rev. Gén. de Botanique*, xl, 474, pp. 328–342; 475, pp. 397–414; 476, pp. 474–485; 477, pp. 555–574; 478, pp. 606–624; 479, pp. 690–704, 12 pl., 46 figs., 1928.

A full account is given of the author's detailed morphological and cytological studies of *Spermophthora gossypii*, *Nematospora*

gossypii, and *N. coryli*, which, especially the first-named, are considered to throw an important light on the phylogeny of the Ascomycetes.

N. gossypii [*R.A.M.*, vii, p. 347] is regarded as differing considerably from *N. coryli*, which, in the author's opinion, is closely related to the true yeasts. The former is a filamentous fungus referable to the Hemiascaceae, and is made the type of a new genus, *Ashbya* [see preceding abstract].

The bearing of these studies on the origin of the Ascomycetes is considered at length. The author places *S. gossypii* [ibid., vii, p. 404] in the new family, Spermophthoraceae, which he considers to be intermediate between the Phycomycetes and the Ascomycetes. In his opinion, the discovery of *S. gossypii* confirms Dangeard's view that the Ascomycetes are derived from the Phycomycetes. The transition from the Spermophthoraceae to Ascomycetes such as *Monascus* and *Pyronema* may be explained by the supposition that in the latter the fusion of the gametes formed in the gametangia is replaced by the fusion of the gametangia themselves, while, owing to delayed nuclear fusion, the sporophyte formed in *Spermophthora* by uninucleate cells with $2n$ chromosomes is changed into a sporophyte composed of cells with two nuclei, each with n chromosomes. The Protoascaceae may be considered as a special branch in which the sporophyte is lacking. *Dipodascus* is one of the most primitive of these, and has apparent affinities with the Hemiascaceae, which, judging from the conditions found in *Ashbya*, may represent archaic forms that have become parthenogenetic, and in which the gametangium has become directly transformed into an ascus.

SCARAMELLA (PIERA). **Ricerche preliminari sul modo di formazione dei conidi nel 'Penicillium digitatum'.** [Preliminary researches into the mode of formation of the conidia of *Penicillium digitatum*.]—*Nuovo Giorn. Bot. Ital.*, N.S., xxxiv, 5, pp. 1078–1084, 2 figs., 1928.

Describing her investigations into the conidial production of *Penicillium digitatum*, the author states that the first conidium is formed by the immature thin-walled conidiophore swelling at the apex. The membrane of this conidium rapidly thickens; at the same time the membrane of that part of the conidiophore immediately under it also thickens and takes no part in the production of the second conidium, the membrane of which is developed within the conidiophore. The wall of the latter forms at the apex a kind of thickened ring or collar, leaving an opening in the centre, and at this point is clearly distinct from the wall of the new conidium forming inside. Early in its formation this conidium shows a distinct membrane only in its upper part (in contact with the previously formed spore) and laterally, where it tapers and merges into the apparently bare protoplasm which is gradually protruded through the pore in the apex of the conidiophore. Later, a thin septum appears also in the lower part of the developing conidium, which is constricted at this point. Following Peyronel, the author terms this type of development 'mesendogenous'.

PETCH (T.). **Notes on root diseases.**—*Tea Quarterly*, i, 4, pp. 104–106, 1928.

In an article in *De Bergcultures*, iii, 2, p. 33, 1928, Gandrup reports that the brown root fungus [*Fomes lamaoensis*] passes from dead *Artocarpus elastica* stumps to the roots of living *Hevea* rubber trees, while the white root fungus (*F. lignosus*) from dead *Leucaena glauca* and rubber stumps also causes infection of living rubber trees. In the same paper a successful experiment in the transmission of the brown root fungus through the soil from coffee to rubber roots is described. Under normal conditions, root diseases in Ceylon are most prevalent in new tea or rubber plantings, and they were consequently very abundant when most of the rubber estates were opened, from 1905 to 1910. There was a recurrence in 1912, when thinning out operations were conducted, and a connexion was frequently traced between the occurrence of *Ustulina* [*zonata*] on dead *Grevillea* stumps and its development on living tea bushes. Similarly, *F. lignosus* was often observed to pass from cacao stumps to rubber. Notwithstanding the general improvement in the sanitation of Ceylon plantations during recent years, similar instances of the passage of root diseases from dead stumps to living trees still occur, and it is of interest to receive confirmation of these facts from Java.

GADD (C. H.). **A new view of the causation of Diplodia disease.**—*Tea Quarterly*, i, 4, pp. 89–93, 2 pl., 1928.

This is a condensed account of the writer's views on the etiology and control of the *Diplodia* disease of tea (*Botryodiplodia theobromae*), a fuller discussion of which has already been published [*R.A.M.*, viii, p. 69].

BUTLER (E. J.). **Report on some diseases of Tea and Tobacco in Nyasaland.**—Dept. of Agric., Nyasaland, 30 pp., 4 pl., 1928.

After a preliminary survey of the climatic and soil conditions of the tea districts of Nyasaland, and of the damage caused by unchecked soil wash in the cleared areas, the author gives a detailed account, based on observations made in 1927, of the principal tea diseases occurring in these regions. Control measures are discussed in each case.

Root and collar crack (*Armillaria mellea*) [*R.A.M.*, vii, p. 275], previously reported on tea only from Uganda and Java [ibid., iii, p. 509; v, p. 585], was observed in Nyasaland on the Mlanje cedar (*Widdringtonia whytei*), mango, *Cedrela toona*, and *Poinciana regia*, in addition to tea, while a brown collar rot of coffee may also be due to this fungus [ibid., vii, p. 239]. On tea *A. mellea* causes a wet rot affecting chiefly the taproot and main laterals. Conspicuous black bands of xylostroma run longitudinally on the surface of affected parts and radial sheets of mycelium separate the wood into wedge-shaped strips lined by dingy or white mycelial sheets. Similar sheets form extensive and continuous layers in the cortex. Rhizomorphs and sporophores are only occasionally formed. Land cleared from forest containing many *Parinarium mobola* and *Afrormosia angolensis* trees suffered most from *A. mellea*, 75 per cent. of the bushes having been killed in one such

case. The disease may occur in spreading patches in which the bushes die slowly or may attack single bushes which usually die very rapidly with the leaves still attached. The affected wood is usually traversed by black lines formed of a bladder-like mycelium which begins in the medullary rays but ultimately involves all the tissues and, when radial, forms xylostroma at the surface and eventually splits the wood along the radius.

No case of root disease of mature tea associated with the presence of *Ustulina zonata* alone was observed, but the symptoms of the disease caused by this fungus were seen on bushes affected by collar crack or other diseases and its fructifications were found on a *Poinciana regia* and an unknown forest tree amongst the tea. In diseased young (one- to two-year-old) bushes *U. zonata* was occasionally found alone. The fungus forms delicate, creamy-white fans at the junction of the bark and wood. The same black line formation and bladder-like mycelium are found as in *A. mellea*. No splitting of the wood occurs, however, and there is no formation of radial sheets or black xylostroma.

Internal root disease, caused by *Botryodiplodia theobromae*, was chiefly observed on young bushes, the fungus apparently being a weak parasite. There is no evidence that it can infect tea by the growth of mycelium from buried stumps. Young tea bushes appear to be more susceptible on cleared grass land, as in northern India.

Sclerotial root disease, due to the *Rhizoctonia bataticola* stage of *Macrophomina phaseoli*, occurred in a severe form on seedlings in a nursery. The leaves of the affected seedlings turn pale, wither, and are shed more or less completely. The shoots die back to the collar, but new ones usually arise at or below soil level and the plants often recover. The rot extends for about half an inch at the seed level, but the lateral roots appear quite free from the fungus. The rotting bark contains characteristic *Rhizoctonia* hyphae, and sclerotia were found in a few roots, and were obtained in culture from others. Only one case of the death of a mature bush from *M. phaseoli* was observed. The bush had dried up completely, and the roots, which bore sclerotia in the inner bark, were bleached, hardened, and unusually light. A pycnidial form agreeing fairly well with *M. phaseoli* developed near soil level on material from a young tea bush brought to England for examination. The spores, however, measured only 16 to 22 by 4·5 to 6 μ, and were thus unusually small. Besides the typical minute sclerotia, larger sclerotioid bodies, often more prominent and shiny, were sometimes formed on the dead roots and collars of bushes of all ages.

The mycelium of a fungus closely resembling *R. crocorum* was found producing a violet growth on the roots of a dead tea seedling.

An obscure disease, sometimes associated with *B. theobromae* or other fungi, is stated to have caused very heavy damage in the Nyasaland tea estates, where it had been attributed to *B. theobromae* [ibid., vii, p. 275]. The leaves of diseased shoots are small, narrow, and pale green, often with upturned edges, the green veins showing up very prominently. The disease progresses slowly and may not kill the bushes for several years. No organism was

regularly associated with it, and it is suggested that a virus may possibly be implicated, though apart from its unusually irregular spread it shows all the characters of progressive underground infection by a parasitic fungus. What appears to be the same disease has also been attributed in India and Ceylon to *B. theobromae* [see preceding abstract], and this fungus is commonly present, probably as a saprophyte, in the later stages of the disease, though absent from early cases.

Stem and branch canker (? *Macrophoma theae*) [ibid., vii, p. 275] was little in evidence in 1927. The branches show swollen, cankerous areas, marked by a longitudinal cracking of the bark, with a protrusion of reddish woody tissue. When the shoot is entirely ringed down to the wood, the branch dies back above the point of attack. The small black pycnidia of *M. theae* or, less often, the light pink cushions of a *Tubercularia* resembling that belonging to the *Nectria* which causes die-back of tea in northern India, may occur on the cankers, and there is little doubt that the hyaline, intracellular mycelium occurring in a few outer layers of the gall wood and in the phloem is the cause of the disease, though inoculations with the above-mentioned fungi were unsuccessful.

Only a few of the tobacco plantations in the Shiré Highlands were visited, but it appears probable that most or all of the diseases recorded in southern Rhodesia and South Africa also occur in Nyasaland. Black stem rot, caused by a *Pythium* related to *P. aphanidermatum*, which was observed in various districts, has not, however, hitherto been reported elsewhere in southern or eastern Africa. The symptoms of the disease agree in essentials with those described from Sumatra [ibid., vi, p. 759]. In its oogonial and antheridial characters [which are described] the causal organism corresponds fairly closely with that described by Carpenter on sugar-cane in Hawaii [ibid., vii, p. 271], but until more is known of this group of parasitic forms the adoption of a new name is considered inadvisable.

Various leaf spotting diseases occur with some severity on Nyasaland tobacco. *Cercospora nicotianae* produces large dark spots, with little or no zonation, on leaves in the curing barns, where it sometimes causes much damage. Other leaf spots include those associated with *Alternaria* sp., *Phyllosticta nicotiana*, *Bacterium tabacum*, and *Bact. angulatum*. Powdery mildew (*Oidium tabaci* or *Erysiphe cichoracearum*) [ibid., vii, p. 278 *et passim*] appears to be gaining ground with the extended cultivation of the moderately susceptible Hickory Pryor variety.

Brief notes are given on the non-parasitic leaf spots known as white speck, white rust, or pox, and red rust, and the prevalent virus diseases, mosaic and ring spot [see above, p. 139].

HOPKINS (J. C. F.). **Precautionary measures against Tobacco diseases.**—*Rhodesia Agric. Journ.*, xxv, 9, pp. 1009–1010; 10, pp. 1112–1115, 1928.

Popular notes are given on the sanitary precautions to be adopted by growers for the avoidance of wildfire [*Barterium tabacum*] and angular leaf spot [*Bact. angulatum*] of tobacco, in amplification of the advice given in a previous paper [*R.A.M.*, vii, p. 478]. The

writer is convinced from his observations that these diseases are brought into the seed-beds on the seed, and that thorough seed disinfection is the first step in effective control. The second is the avoidance of contamination from old tobacco refuse. The seedlings should be regularly sprayed with 4-4-50 Bordeaux mixture, about once a week. Attention is drawn to the danger of allowing men to chew tobacco [ibid., vii, p. 477] while working. General instructions are also given for the sterilization of the soil of the seed-beds, burning being recommended for this purpose.

GREGORY (C. T.). **Controlling Tomato leaf mould in greenhouses in Indiana.**—*Proc. Indiana Acad. Sci.*, xxxvii (*1927*), pp. 382–385, 2 figs., 1928. [Received January, 1929.]

Neither Burgundy mixture (2–3–100) nor 25 per cent. copper-lime dust has given complete control of tomato leaf mould (*Cladosporium fulvum*) in Indiana [*R.A.M.*, vii, p. 749], but both materials retard the disease sufficiently to permit ripening of the fruit. The duster must deliver a sufficient quantity of dust to fill the entire greenhouse, while the spray should be applied at not less than 200 lb. pressure. Preliminary tests indicate that the spores of the fungus may be carried on the strings used to support the vines.

WESTERDIJK (JOHANNA). **Is de Iepenziekte een infectieziekte?** [Is the Elm disease an infectious disease?]—Reprinted from *Tijdschr. Nederl. Heidemaatsch., 1928,* 10, 5 pp., 1928.

The author's reasons for regarding the Dutch elm disease as due to infection and not to physiological causes are concisely outlined [*R.A.M.*, vii, pp. 680, 681]. The parasitic character of the disturbance is manifested by the severe, local attacks on young, vigorously growing branches; by the manner in which the infection spreads from one tree to its neighbour; and by the occurrence of the disease on all types of soil—sand, clay, or marsh—and in both damp and dry sites. The fact that the acute symptoms of the elm disease are restricted to dry seasons merely indicates that the causal organism, *Graphium ulmi* [see next abstract], thrives particularly well under such conditions. The only hope of eradicating the disease is considered to lie in the selection of resistant varieties and in the destruction of infected material.

BUISMAN (CHRISTINE J.). **De oorzaak van de Iepenziekte.** [The cause of the Elm disease.]—Reprinted from *Tijdschr. Nederl. Heidemaatsch., 1928,* 10, 7 pp., 1928.

After a brief discussion of the current theories on the etiology of the Dutch elm disease [see preceding abstract], the author describes her inoculation experiments with *Graphium ulmi*, which was consistently isolated from infected material in June, 1927. The tests were carried out on five-year-old layers of different varieties of the *Ulmus campestris* and *U. monumentalis* type grown on diverse kinds of soil. Negative results were given by applying mycelium and spores to surface wounds and by needle prick inoculations, as well as by smearing the leaves with spores. On the other hand, the typical dark stripes developed in the wood of branches inocu-

lated with aqueous spore suspensions of the fungus by means of a hypodermic needle. The experiments were resumed in June and July, 1928, when conditions were again very favourable to the development of infection. The leaves began to wither nine to twelve days after inoculation and *G. ulmi* was readily isolated from the diseased branches. Successful results were also given by the inoculation of the roots with spore suspensions of the fungus, although this mode of infection has hitherto not been observed in nature. The results of these tests are considered to prove beyond a doubt that *G. ulmi* is the causal organism of the elm disease.

Attention is drawn to the great difficulty of detecting the presence of *G. ulmi* in diseased wood, owing to the development of brown tyloses in the infected vessels.

Under certain conditions the elm diseases caused by *Nectria cinnabarina, Verticillium dahliae* [*R.A.M.*, vi, p. 135 ; vii, p. 352], *Phomopsis* sp., and a hitherto undescribed bacterium may be confused with the trouble under discussion.

According to Biourge, *N. cinnabarina* produces symptoms resembling those of the Dutch elm disease, especially on horticultural varieties. The crown is first attacked, the upper leaves wither, and subsequently the lower branches become affected. There is, however, a sharper contrast between diseased and healthy branches than in the case of the Dutch elm disease, and the well-known brown stripes typical of the latter are absent in the wood of branches attacked by *N. cinnabarina.* The red fructifications of this fungus are also plainly visible in the autumn on infected trees.

V. dahliae has only been observed by the writer in elm seedlings growing on land formerly under potatoes, where the soil was infested by the fungus. The brown discoloration resulting from infection by *V. dahliae* is somewhat translucent and is less sharply delimited than that caused by *G. ulmi.* Moreover, the former occurs on young, and the latter chiefly on older trees.

A species of *Phomopsis* causes a brown discoloration and withering of the foliage, especially of heavily shaded branches, similar to that of the early stages of the elm disease. Closer inspection of the affected branches reveals the presence of small cankers or of dead cortex, in which, as well as in the wood and medulla, numerous hyphae occur.

The microscopical examination of some elm branches showing dark stripes running downwards from the pulvinus and suddenly ceasing, revealed the presence, in sections of the wood vessels, of quantities of rod-shaped bacteria quite distinct from the spherical ones described by Brussoff as *Micrococcus ulmi* [ibid., vii, p. 353]. This condition, which never assumed the acute form typical of the elm disease, was extremely prevalent in all the material examined by the writer. Affected trees show no sign of attack apart from a somewhat sparse leafage. The dark stripes differ from those caused by *G. ulmi* in various points. Thus, the former are continuous, very sharply delimited, black, often situated close to the medulla, and their course is easy to follow through a branch or leaf. On the other hand, the fungous stripes are interrupted, merging gradually

into the surrounding wood, dark brown, never observed near the medulla, and their course is difficult to follow. The risk of confusion between bacterial infection and the genuine elm disease cannot be too strongly emphasized. In many cases of serious infection by *G. ulmi* the author observed only bacterial stripes in the younger branches. The results of numerous inoculation experiments with the elm bacterium (a description of which is to be published later) showed that the dark stripes may run for a considerable distance in an upward and downward direction, but they do not reach the trunk.

None of the other elm diseases encountered approaches in severity the epidemic disease caused by *G. ulmi*.

PETRI (L.). **Ricerche sul 'mal del falchetto' del Gelso.** [Researches on 'falchetto' disease of Mulberry.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 3, pp. 231–234, 1928.

Investigations into the wilt of mulberries known in Italy as 'falchetto' disease, which exists both in a rapid form associated with a root rot hitherto attributed to *Armillaria mellea* (though the disease has never been reproduced experimentally) and also as a gradual withering of the branches from the top of the tree downwards, gave the following results.

The slow form of the disease was not found to be associated with the regular presence of any parasitic organism, but is thought to be due to exhaustion from drastic and persistent pruning during the vegetative period. When root rot is associated with this slow form, which is only sometimes the case, it is indirectly due to unsuitable soil or is secondary to the withering of the aerial parts.

The rapid wilt is caused by infection of the collar by a fungus which is considered to be probably a species of *Phytophthora*. At a later stage this fungus is followed by *A. mellea* and other Basidiomycetes, or by *Fusarium*. As this form presents striking analogies with the ink disease of chestnut [*P. cambivora*], the author suggests testing the method of control by exposing the roots to the air, recently described by Gioda [see above, p. 141].

HAAS (A. R. C.), BATCHELOR (L. D.), & THOMAS (E. E.). **Yellows or little leaf of Walnut trees.**—*Bot. Gaz.*, lxxxvi, 2, pp. 172–192, 5 figs., 1928.

Walnut yellows or little leaf is characterized by the production of small, yellowish-green foliage, twigs with extremely short internodes, densely clustered compound leaves, and leaflets measuring one-tenth or less of the normal size. The dorsal surface of the petiole of the compound leaf shows a convex curve, while the leaflets are commonly curved in a similar manner. Marginal burning, resulting from an excessive salt content of the soil solution or other toxic conditions, may or may not be present. The roots are brownish, unhealthy, and deficient in rootlets. In advanced stages there may be an actual die-back of the terminal growth, and the tree may be killed. Spontaneous recovery from yellows has been observed in young (one- to ten-year-old) trees; and, conversely, trees that have developed normally for ten to fifteen years may

gradually develop more or less severe symptoms. Walnut yellows is widely distributed in southern and central California, especially on various types of sandy and clay loam.

The writers' observations [which are fully discussed and the analytical data tabulated] strongly suggest that a group of tree disturbances, including walnut yellows, pecan rosette, citrus mottling, and little leaf of peaches and apricots [cf. *R.A.M.*, vi, p. 132; vii, p. 792 *et passim*] are due to a similar cause. They have all been found to occur independently of the nitrogen requirements, the anion content of the water extract of the soil, climatic factors, cultural and irrigation practices, nematode (*Heterodera radicicola*) infestation, and soil types, but appear to be correlated with the base relationship in the soil.

When the above-mentioned trees were grown between two adjacent plots, one of which had been fertilized annually for 13 years past with 486 lb. of nitrate of soda, 500 lb. of dried blood, and 1067 lb. of steamed bone meal per acre, while the other had received annually 972 lb. of nitrate of soda per acre, the group of physiological diseases referred to developed. Presumably the soil bases have been undergoing exchange with the bases (principally sodium) in the fertilizer applied, resulting in the liberation of calcium, magnesium, and potassium into the soil solution, and their substitution by sodium in the soil complex. Rosetted pecan leaves were produced in soil cultures by a replacement of the soil bases with potassium nitrate solution. Experiments are in progress in which severe mottling of orange trees has been induced by mixing sodium carbonate, potassium carbonate, or sodium aluminate with the soil. In this case, presumably, excessive alkalinity has prevented the trees from a full utilization of the calcium and other bases most required during the maturing of the leaves. It is also possible that the disease in question may be caused by the gradual absorption of toxic agents in exceedingly minute quantities.

It was found that the ash of affected walnut leaves is lower in calcium and higher in potassium than that of healthy foliage. The percentage of calcium in the ash of the water-soluble fraction of diseased leaves increases with advancing maturity until it finally exceeds that of healthy ones. Nearly all the calcium in the dry matter of healthy leaves is insoluble in water. The sap drawn by suction from diseased walnut branches shows a higher calcium concentration than that from healthy branches. Practically no differences were found to exist in the ash composition of the expressed juice of healthy and diseased walnut leaves, but the latter have a lower P_H value and a greater total acidity than normal foliage.

KORFF [G.] & FLACHS [K.]. **Für die Kartoffelausfuhr zurzeit geltende Vorschriften.** [Regulations now in force for Potato export.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, vi, 7, pp. 161–165, 1928.

The regulations governing the importation of potatoes into various European countries are summarized and briefly discussed, and attention is drawn to the urgent necessity of a strict observance of these rules on the part of German exporters.

IMPERIAL BUREAU OF MYCOLOGY

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MEINECKE (E. P.). **The evaluation of loss from killing diseases in the young forest.**—*Journ. of Forestry*, xxvi, 3, pp. 283–298, 3 diags., 1928.

During the summer of 1923 an investigation was conducted in the Sierra Nevada, California, on the losses in young stands of yellow pine (*Pinus ponderosa*) from the rust *Cronartium pyriforme*, the alternate host of which is *Comandra umbellata*.

Six plots were selected, varying in surface from $\frac{1}{10}$ to $\frac{2}{5}$ of an acre. The trees of two plots at an altitude of 2,800 ft. on fairly good sites in a mixed forest ranged from 14 to 15 and 18 to 20 years old, respectively, while those in the remaining plots on poor sites were somewhat older. The height of each tree was measured and notes were taken on the incidence of infection. The trees were divided into four classes, namely, sound, slightly infected, fatally infected, and killed. All infections on the main stem, or on branches very close to the latter so that extension to the stem was fairly certain, were classed from experience as fatal. The infections on outer parts of a branch, on the other hand, are shed with the killing of that part of the branch and do not cause loss in the sense here discussed. Direct infection from pine to pine does not take place, and as the alternate host had been largely killed out by the rust, new infections were not occurring to an appreciable extent. New regeneration pine seedlings were also not likely to appear, as mature trees were rare. It was necessary to adopt a standard whereby density relations could be measured in relation to development during the next few decades, and for this purpose the crown spread of the tree was studied, its diameter being taken as one-half the height of the tree. On the basis of this standard an area is considered adequately stocked when the distance between the crowns of adjacent trees does not materially exceed the crown diameter established for the average height of the trees on each plot.

The results of this investigation [which are tabulated] showed that this method (applied to four of the six plots) was superior to those ordinarily employed by the Forest Service in supplying a

correct interpretation of the data. It was found that the reduction in prospective forest cover ranged from 8 to 33 per cent., with an average of 21 per cent., in the four plots.

It is pointed out that this method cannot be applied to other killing forest diseases without certain modifications dictated by the nature of the fungi and hosts involved. In most cases the evaluation of losses will probably be much more complex than in that of *C. pyriforme* on *P. ponderosa*.

HEMMI (T.) & NOJIMA (T.). **Studies on Polyporus orientalis parasitic on the roots of Pine trees.**—*Ann. Phytopath. Soc. Japan*, ii, 2, pp. 70–88, 2 pl., 1 graph, 1928. [Japanese, with English summary.]

Polyporus orientalis, a stipitate yellow fungus first described by Lloyd in 1912, is believed to be endemic in Japan. It has been found widely distributed in the south of Honshu and in Kiushu, slowly producing white pockets in the woody tissue of pine roots. Near Kyoto *P. orientale* frequently occurs on living and dead roots of *Pinus densiflora* in stands over thirty years old.

The writers here describe the morphological and physiological characters of the fungus, pure cultures of which were readily obtained by placing fragments of fungus tissue and rotting wood on agar plates in Petri dishes. Of the 16 different media used in the experiments, apricot decoction agar proved the most suitable for mycelial growth, the optimum temperature for which was found to lie between 28° and 32° C., with a maximum and minimum at 38° and just below 12°, respectively.

P. orientalis was shown to belong to the lignin-dissolving group of fungi [cf. *R.A.M.*, vii, p. 690].

RIOFRÍO (B. F.). **Acerca de dos Uredales heteroicos.** [Concerning two heteroecious Uredinales.]—*Bol. R. Soc. Española Hist. Nat.*, xxviii, 7, pp. 405–410, 1928.

In the spring of 1925 the pycnidia and aecidia of a species of *Peridermium* were observed on the leaves of *Pinus halepensis* in several localities between Barcelona and Valles. Since that year the fungus has spread rapidly and appears to be causing considerable damage to young trees. *Coleosporium inulae* is of frequent occurrence on *Inula viscosa* in the neighbourhood of the affected pines, and the results of inoculation experiments demonstrated a genetic connexion between the teleutospores of this rust and the *Peridermium*, which was identified as *P. pini*. The locality in which *P. halepensis* was attacked is without stands of *Pinus sylvestris*, the normal aecidial host of *C. inulae*. It appears probable, therefore, that *C. inulae* is capable of parasitizing either species of pine according to its predominance in the neighbourhood.

BAVENDAMM (W.). **Neue Untersuchungen über die Lebensbedingungen holzzerstörender Pilze. Ein Beitrag zur Frage der Krankheitsempfänglichkeit unserer Holzpflanzen. I. Mitteilung: Gasversuche.** [Recent investigations on the conditions governing the existence of wood-destroying fungi.

A contribution to the problem of susceptibility to disease in our woody plants. Note I; Gas experiments.]—*Centralbl. für Bakt.*, Ab. 2, lxxv, 15–24, pp. 426–452; 25–26, pp. 503–533, 8 figs., 1928.

Continuing his investigations on the conditions governing the development of wood-destroying fungi [*R.A.M.*, vii, p. 68], the author here gives a detailed account of his researches on the reaction of these organisms to their substratum, i. e., to nutritional and physiological factors [cf. ibid., vii, p. 689].

Thirty-two wood-destroying fungi (4 Ascomycetes and 28 Basidiomycetes) were grown on a nutrient medium in Petri dishes and exposed to the influence of various gases and gas pressures by means of different appliances [the construction and use of which are indicated]. The results of the experiments [which are tabulated and described in detail] showed that growth was possible at an air pressure of $\frac{1}{8}$ atmosphere but ceased entirely at $\frac{1}{16}$. Even six days' exposure to an atmosphere deprived of oxygen did not kill the fungi, though their growth was inhibited. Some of the organisms, e. g., *Stereum frustulosum*, *S. hirsutum*, and *S. rugosum*, withstood the oxygen shortage for still longer periods (six to ten weeks). The parasitic heartwood fungi in general, as well as *Lenzites abietina* and *L. sepiaria* among the saprophytes, proved highly resistant to the withdrawal of oxygen, to which *Merulius lacrymans* and *Coniophora cerebella* were the most susceptible of the organisms tested (cessation of growth after two to three days).

The results of a series of tests on the influence of carbon dioxide showed that the growth of practically all the fungi investigated was checked to a marked extent by an excess of CO_2 of 19 per cent., while higher concentrations (over 80 per cent.) completely arrested their development. Even at these concentrations, however, the organisms were not killed.

FOSTER (J.). **Preservation of mine timber.**—8 pp., 4 figs., 1 diag., London, British Wood Impregnating Co., Ltd., [1928.]

During a recent visit to the Ruhr coalfield the writer was much impressed by the completeness of the timber preservation equipment at practically all the collieries inspected. Experience has shown that the quantity of timber consumed is reduced by 20 per cent. as a result of preservative treatment, while the cost of constant resetting is avoided and falls of roof are less frequent.

One of the most popular preservatives is triolith, a compound consisting of dinitrophenol sodium fluoride, and another salt stated to prevent the corrosion of metal (Wolman process) [*R.A.M.*, vi, p. 707; vii, p. 690]. This preparation is further reputed to be fire-resistant and is applied in the same way as creosote.

The typical plant in use at the Rhein Preussen Colliery near Essen consists of a mixing tank, in which the triolith solution is prepared; an impregnation cylinder; a pressure chamber to feed the solution into the cylinder as absorption proceeds; a storage tank below ground level; and a ram pump capable of dealing with pressures from 5 to 9 atmospheres. A boiler of approximately 2,600 cu. ft. capacity takes about 800 props each 6 ft. 6 in. long and 8 to 9 in. in diameter. Heating pipes are also provided to keep the

solution at a temperature of 90° C. The air is exhausted from the impregnation chamber and the vacuum maintained for 30 minutes. The triolith solution is then drawn into the cylinder and the pressure chamber filled. The pressure is maintained until the timber has absorbed 1 gall. of solution per cu. ft. of wood, after which the surplus solution is run into the storage tank.

Triolith being effective as a 2 per cent. solution (1 lb. per 5 galls. of water) and its cost being under fourpence per gall., this process of impregnation is relatively economical. Applied at the same rate, creosote costs about eightpence per gall., and this preparation has the further drawbacks of inflammability and of causing irritation of the skin.

Although the best results are obtained by the pressure system of impregnation, the open-tank method is adequate where the timber is only required for short periods. The wood is immersed in a warm solution of the salts at a temperature between 140° and 180° F.

TEESDALE (L. V.). **The control of stain, decay, and other seasoning defects in Red Gum.**—*U.S. Dept. of Agric. Circ.* 421, 18 pp., 7 pl., 1 graph, 1927. [Received December, 1928.]

Field experiments [details of which are given], made in 1925 in the southern hardwood area of the United States, showed that spraying freshly felled logs of red gum (*Liquidambar styraciflua*), left in the woods, with a mixture of 1 part cresylic acid and 10 parts of kerosene or crude oil, by weight, effectively controlled fungal decay and retarded the spread of blue stain [caused by fungi of the composite species *Ceratostomella pilifera*] during periods of five weeks of hot summer weather, and of three months in the late summer and autumn. Coating the cut ends of the logs with a mixture of 1 part cresylic acid and 10 parts hardened gloss oil (a cheap varnish made up of 100 parts rosin, 8 parts quicklime, and 57·5 parts naphtha) also prevented decay and reduced blue stain. The best results in preventing cracking of the ends of the logs were obtained by treating them with the same mixture as above, but with the addition to the gloss oil of 25 parts asbestine and 25 parts barytes; this mixture also appeared to be more effective than the others in the control of stain.

Further observations in the field showed that the blue stain fungi that enter the logs through abrasions in the bark make rather slow progress across the grain of the wood, and the resulting stain can usually be shaved off in the mills, unless the logs are stored for long periods, in which case the sides of the logs should be sprayed with a cresylic acid mixture or other suitable fungicide.

A discussion is also given of the conditions in the field and in timber yards that favour the attack and development of wood rotting and staining fungi, and recommendations are made for various methods for the seasoning of the timber, based on comparative tests, details of which are briefly described.

WORMALD (H.) & FRAMPTON (Miss A. M.). **Note on 'black rot' of cruciferous plants.**—*Ann. Rept. East Malling Res. Stat. 1926 and 1927, II Supplement*, pp. 108–110, 2 figs., 1928.

The author states that in 1925 a yellow bacterium with a single

polar flagellum was isolated from a broccoli plant at East Malling showing symptoms of black rot (*Pseudomonas campestris*) [*R.A.M.*, vi, p. 528]. Comparison with a type culture of *P. campestris* sent from Washington (simultaneous physiological tests being made) showed that the salient characters of both strains were indistinguishable, the East Malling strain having the same group number as the type organism, viz., 211.3332513. Inoculations of broccoli plants with pure cultures of the East Malling strain gave positive results, the organism being re-isolated from an inoculated plant which became infected. The paper terminates with brief notes on control.

QUANJER (H. M.). **De invloed van kaligebrek op de vatbaarheid van Bloemkool voor Peronospora parasitica.** [The influence of potash deficiency on the susceptibility of Cauliflower to *Peronospora parasitica*.]—*Tijdschr. over Plantenziekten*, xxxiv, 10, pp. 254–256, 2 pl., 1928. [English summary.]

The writer briefly describes the results of a recent examination of cauliflower plants on two plots—one receiving applications of potash and the other left unfertilized. The plants on the former plot showed a yellow discoloration of the intercostal areas of the leaves, which failed to unfurl and drooped downwards at the edges. The leaf edges sometimes also showed an incipient yellow discoloration, this feature being still more pronounced in white cabbage, the edges of which bore various saprophytic Dematiaceae on the unfertilized plots. The most important difference between the two plots, however, was that the cauliflowers suffering from potash deficiency were severely attacked by *Peronospora parasitica* [*R.A.M.*, v, p. 643], while the fertilized plants were only slightly attacked.

GREGORY (C. T.). **New yellows resistant varieties of Cabbage in Indiana.**—*Proc. Indiana Acad. Sci.*, xxxvii (*1927*), pp. 381–382, 1928. [Received January, 1929.]

The yellows [*Fusarium conglutinans*] -resistant cabbage selections [*R.A.M.*, viii, p. 157], e. g., Marion Market, Allhead Select, and Iacope are stated to be very successful in Indiana, where the ordinary commercial Golden Acre and Glory of Enkhuizen varieties are heavily damaged. Among the resistant late varieties the Wisconsin All Seasons, Wisconsin Succession, Wisconsin Hollander, and Indiana are popular, while the Chicago variety, Bugner, is less acceptable on account of its coarse leaves and frequent failure to head.

TOGASHI (K.). **Three Fusaria which cause the wilt disease of Pea.**—*Japanese Journ. of Botany*, iv, 2, pp. 153–188, 5 pl. (2 col.), 1 fig., 1928.

Full morphological and cultural particulars are given of three species of *Fusarium* causing wilt of cultivated peas at Kyoto. The cultural characters and dimensions of the three species, *F. arthrosporioides*, *F. sporotrichioides*, and *F. anguioides*, are tabulated and compared with those of *F. martii* var. *minus* [*R.A.M.*, v, p. 465],

with which *F. martii* var. *pisi* [ibid., iv, p. 456] is thought to be identical.

Eight series of inoculation experiments were carried out under controlled conditions in the greenhouse on different pea varieties to ascertain the pathogenicity of the three fungi under discussion and their relative infective capacity. It was shown that *F. arthrosporioides* was the most virulent (75 per cent. infection, compared with 17 and 20·4 per cent. for *F. sporotrichioides* and *F. anguioides*, respectively). The Alaska variety was much more resistant than Pioneer, Sensation, Gladstone, Duke of Albany, and V.C. In a comparative test including *F. martii* var. *minus* this organism caused heavier damage than the three other species (100 per cent., as against 80, 6·6, and 10 per cent. for *F. arthrosporioides*, *F. sporotrichioides*, and *F. anguioides*, respectively).

The first symptom of infection by *F. arthrosporioides* is a development of reddish-brown streaks on the stems at ground level. These streaks extend to just above the point of attachment of the cotyledons, becoming coalescent and dark to blackish-brown, and they also appear above ground, girdling the stem. The light orange sporodochia are produced on the portions of the stem at or above ground level. Affected plants are retarded in growth, shrivelled, with yellowish foliage; the incipient symptoms of wilting become apparent as soon as extensive vascular invasion takes place. Usually the plants die very slowly. The most severely damaged seeds fail to germinate and rot below the ground, surrounded by hyphae.

Similar symptoms are observed in the case of the other two species, as well as in plants attacked by *F. martii* var. *minus*. The last-named fungus, however, also invades the rootlets, which are replaced by new ones at or above the point of infection. In the experiments with the three other species this phenomenon was only observed in the case of *F. anguioides*. The sporodochia of this species show a greyish coloration, in contrast to the light ochraceous buff of *F. arthrosporioides* and the ochraceous buff, salmon buff, or grenadine pink of *F. sporotrichioides*.

A list is given of the species and varieties of *Fusarium* hitherto recorded on peas suffering from wilt, foot disease, and stem or root rot in various countries.

LINFORD (M. B.). **A Fusarium wilt of Peas in Wisconsin.**—*Wisconsin Agric. Exper. Stat. Res. Bull.* 85, 44 pp., 9 figs., 5 graphs, 1 map, 1928.

This is a detailed account of the *Fusarium* wilt of peas which was recorded in Wisconsin in 1924 and was briefly described by the author in a previous paper [*R.A.M.*, v, p. 461]. Outside Wisconsin, in the southern part of which it is fairly generally present, the wilt was also found, in 1926, locally in Indiana and Michigan. In some parts of Wisconsin this is the most destructive disease of peas grown for canning, while for the whole of that State its economic importance is stated to be second only to that of the *Aphanomyces* [*euteiches*: cf. ibid., vii, p. 354] root rot.

Cultures of the causal organism were referred by Wollenweber to *F. orthoceras*, although they showed some divergence in pigmentation from the type of the species. Compared by the author with cultures of authentic *F. orthoceras*, the pea-wilt fungus differed in the paucity of its microconidia and almost complete absence of macroconidia, and also in the absence of vinaceous colours on potato-dextrose agar and other minor cultural characters. Although it is believed that the fungus is distinct from *F. orthoceras*, it is thought best to consider it tentatively as a variety of that species because of its predominantly unseptate conidia, the abundance of thick-walled chlamydospores, and the pigmentation in culture on rice. On potato-dextrose agar growth occurred at temperatures ranging from 6·5° to 35° C., but was most rapid at 27° to 30°.

The fungus chiefly invades the xylem of the roots and the lower half of the stem. No conspicuous cortical lesions are formed. Preliminary symptoms of wilt usually appear before the fungus is present in large quantities, and the more significant symptoms of the disease cannot be attributed to the obstruction of the vessels by the mycelium.

The fungus was found to cause a similar disease in *Vicia gigantea*, a native perennial vetch of California and Nevada, and to be weakly pathogenic to *V. faba*, but no other hosts have yet been found.

Experiments in Wisconsin soil temperature tanks showed that most rapid germination and early growth of peas occur at temperatures from 24° to 27°, but that 18° to 21° is the optimum temperature for growth over long periods. The soil temperature range for the development of the disease was shown to be from 10° to 30°, but severe injury occurred chiefly between 18° and 24°. Below 16° characteristic wilt did not develop. The optimum soil temperature for this disease is, thus, below that for the rapid growth of the fungus, but very near that for growth of the healthy pea plant. The retardation of wilt at optimum temperatures for rapid growth of the organism in pure culture is believed to indicate a condition of induced temporary resistance in the host. Soil moisture was found to have less influence on the wilt than temperature. Wet soil slightly favoured the early appearance of the symptoms, while drier soils favoured more rapid death of affected plants.

Wilt causes the most severe losses in areas where peas are grown repeatedly. Spread occurs mainly with contaminated soil or refuse, an important factor in this respect being the improper disposal of pea vines from infected fields. Besides the usual recommendations, based on the above observations, the most promising means for the control of wilt is offered by the well-defined varietal resistance observed in trials made in 1925 and 1926. Several varieties, including Green Admiral, Yellow Admiral, Horal, and Rice's 330, have shown marked resistance, and it was also found that susceptible varieties usually contain a few plants that are highly resistant, selections from which yielded numerous resistant progenies, which may serve to develop new resistant varieties acceptable to the pea-canning industry.

HEDGES (FLORENCE). **Bacterial diseases of Beans in some western commercial seed-growing and canning areas and southern trucking sections in 1927 and 1928.**—*Plant Disease Reporter*, xii, 11, pp. 121–122, 1928.

The so-called 'halo spot' disease (*Bacterium medicaginis* [var.] *phaseolicola*) [*R.A.M.*, vi, p. 331] is stated to have destroyed extensive areas under beans [*Phaseolus vulgaris*] in Montana, Wyoming, and Colorado, and was also reported from Utah, during 1927–8. Severely infected leaves are peppered with water soaked spots, surrounded by wide pale or yellowish-green haloes, and finally become brown and dry. The stems and petioles are very liable to attack, especially at the pulvinus, and develop a reddish discoloration. A whitish exudate often appears at fissures in the stem. The symptoms on the pods closely resemble those due to *Bact. phaseoli*. The wilt commonly observed by Burkholder in plants attacked by halo spot was absent in the fields inspected by the writer. *Bact. medicaginis* var. *phaseolicola* is seed-borne and its development is favoured by cold, rainy weather.

Bact. phaseoli caused heavy losses through stem-girdling in Utah, but the blight due to this organism was not observed in Montana, Idaho, or California. Both this disease and halo blight (especially the latter) were severe in Florida and Georgia. In South Carolina and Wisconsin halo blight was also present, but in a comparatively mild form. The widely grown shell bean variety, Great Northern, appears to be immune from halo blight, to which all the popular canning varieties, except Refugee, are highly susceptible.

DUFRÉNOY (J.). **Études cytologiques de Haricots sensibles et de Haricots résistants au Colletotrichum lindemuthianum.** [Cytological studies of Beans susceptible and resistant to *Colletotrichum lindemuthianum.*]—*Rev. Path. Vég. et Ent. Agric.*, xv, 7, pp. 186–187, 4 pl., 1928.

When beans [*Phaseolus vulgaris*] of a commercial variety infected with *Colletotrichum lindemuthianum* [*R.A.M.*, vi, p. 456] and a hybrid line (63–2) were grown together, the cells surrounding the lesions in the former remained living and full of amyloplasts though permeated by the mycelium, while the latter showed only a slight trace of infection and there was a more general production of tannin cells in tissues in the vicinity of the spots, these tannin cells remaining free from mycelium. In both cases, however, the mitochondria of the cells some distance away from the infected cells underwent vesicular modification closely resembling that observed in mosaic bean leaves [ibid., vii, p. 660; viii, p. 188].

Artificial infection experiments with three American strains of *C. lindemuthianum* [ibid., iii, p. 110] showed that inoculation with the A strain on the young leaves of the line susceptible to it produced decay, while inoculation with the same strain produced only isolated, though distinct, lesions on the stems of line 83, and this line showed no macroscopic lesions at all when inoculated with the B strain.

ESMARCH (F.). **Die Herz- und Trockenfäule der Rüben.** [The heart and dry rot of Beets.]—*Die Kranke Pflanze*, v, 10, pp. 161–163, 1 fig., 1928.

A popular description is given of the symptoms of heart and dry rot of beets, formerly attributed to infection by *Phoma betae* and other fungi but now considered to be due to metabolic disturbances [*R.A.M.*, vii, p. 760]. The disease is most prevalent in dry weather and occurs exclusively on alkaline soils. The application of phosphoric acid appears to reduce the tendency to heart and dry rot, while lime, kainit, and saltpetre increase it. The disease may be controlled by the conservation of soil moisture; moderately late sowing; selection of deep rooting varieties with smooth, flat leaves; and crop rotation, leaving at least four years between each beet crop.

GÄUMANN (E.). **Ueber die Bekämpfung des Wurzelbrandes der Zuckerrüben.** [On the control of root rot of Sugar Beets.]—*Landw. Jahrb. der Schweiz*, xlii, 2, pp. 571–582, 1 diag., 1928.

In Switzerland root rot of beets may be caused by *Phoma betae* in soils of an alkaline, neutral, or acid reaction, whereas the other common cause of this disease, *Pythium de Baryanum*, is practically restricted to acid ones. The latter lives as a saprophyte in the soil, while the former is usually introduced on the seed. The results [which are tabulated] of three years' investigations (1925 to 1927) on virgin peat soil showed that the incidence of infection by *P. de Baryanum* increased with the acidity of the soil, and probably also with a rising humus content, coinciding with a decrease in the amount of lime present. In neighbouring soil, where the disease was rare, the P_H value was higher than in the virgin soil (7·5 against 6·75), and the humus content was only 5·5 compared with 21·3 per cent. The application of lime, in quantities up to 4,000 kg. $CaCO_3$ per hect., failed, however, to give reliable control of the disease due to this fungus, as apparently the P_H value is not sufficiently altered to affect its vitality. The disease was, however, held in check by two very liberal applications of an acid or neutral complete fertilizer (120 kg. of phosphoric acid, 60 kg. of nitrogen, and 180 kg. of potash per hect.). The average financial increase resulting from this treatment over the three-year period may be estimated at 35 to 40 per cent. It is thought that the plants receiving the complete fertilizer made sufficiently rapid growth to escape the critical period for infection in June.

AYYANGAR (C. R.). **A leaf spot and blight disease of Onions caused by Alternaria palandui nov. sp.**—*Agric. Res. Inst., Pusa., Bull.* 179, 14 pp., 2 pl., 1 graph, 1928.

In December, 1926, an apparently new leaf disease of Bellary onions, caused by a species of *Alternaria*, was observed at Coimbatore, Madras. The first symptoms of infection are small, whitish flecks, which expand into sunken lesions with greyish centres and yellowish margins. The leaves gradually turn yellow from the tip downwards and dry up. Sometimes they droop at the infected region and the distal portions are severed at the bend. The

hyaline to fuliginaceous mycelium of the fungus grows on the surface of the lesions and within the host tissues. The hyaline hyphae measure 1·75 to 12·25 μ in thickness and the coloured ones 1·75 to 10·25 μ. The smoky-brown conidiophores bear at their apices chains of spores varying in number from two to eight. The spores taken from the host are dark brown, mostly obclavate but sometimes oblong or elliptical, the apical portion tapering to a simple beak of varying length; they are pluriseptate, sometimes muriform (some of the middle cells being at times divided by a longitudinal wall) and measure 10·5 to 77 by 3·5 to 14 μ (average 28·6 by 7·5 μ). In culture on different organic media the spores varied from 10·5 to 63 by 7 to 21 μ (average about 36 by 10 μ) and the number of septa was from 1 to 8.

Comparative cultural studies [details of which are given] were carried out with this species of *Alternaria* and *A. allii*, isolated from onions in Porto Rico [*R.A.M.*, vi, p. 524]. In addition to various cultural differences [which are described], the morphological characters of the Coimbatore *Alternaria* are quite distinct from those of *A. allii*, *A. dianthi*, and *A. brassicae*, and the first-named is accordingly regarded as a new species, *A. palandui*. Inoculation experiments on a number of plants, viz., radish, *Datura*, cotton, cabbage, and *Dianthus*, with both species, showed that onions only are susceptible. Infection takes place most readily through wounds. The spores of *A. palandui* were killed by 30 minutes' immersion in copper sulphate or germisan solutions at a concentration of 0·05 per cent. and above.

NICOLAS (G.) & AGGÉRY (Mlle). **Un cas intéressant de dépérissement de Persil.** [An interesting case of Parsley wilt.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 7, pp. 182–183, 5 figs., 1928.

In the rootlets of wilted parsley plants which were dwarfed, with the lower leaves withered and the upper yellowish, and with most of the lateral rootlets destroyed, the authors observed a continuous mycelium with numerous, spherical, echinulated, thick-walled oogonia containing one or more large oil drops, and measuring 28 to 36 μ in diameter without the protrusions, and up to 45 μ with them. Antheridia were not observed. Thin-walled, spherical sporangia, either isolated or in short chains, were also present. Placed in water the affected rootlets gave rise to a mycelium bearing sporangia terminally or intercalarly, up to 47 μ in diameter, and a few oogonia measuring 23·5 μ. The fungus was identified as a parasitic form of *Pythium megalacanthum* de Bary.

FERRARIS (T.). **La peronospora dello Spinacio.** [The *Peronospora* of Spinach.]—*Curiamo le Piante!*, vii, 10, pp. 187–189, 1 pl. [on cover], 1928.

Brief notes are given on the symptoms and control of downy mildew of spinach (*Peronospora effusa*). Affected leaves, especially those first attacked, should be removed, as should alternative hosts of *P. effusa*, such as *Chenopodium album* [*R.A.M.*, vi, p. 570]. In areas where the fungus is constantly present the crop should be changed. Organic fertilizers, especially stable manure, should be used sparingly, and mineral fertilizers more generously; the

soil should be lightly limed. Very light applications of 0·5 per cent. Caffaro powder are recommended (the plants are well washed in Italy before being sent to market), as is dusting with a mixture consisting of 2 parts Caffaro powder and 8 parts finely powdered quicklime.

GUBA (E. F.). **Control of Cucumber powdery mildew in greenhouses.**—*Phytopath.*, xviii, 10, pp. 847–860, 1 pl., 2 figs., 1 diag., 1928.

A full account is given of a series of experiments carried out from 1925 to 1928, inclusive, in Massachusetts, to determine the relative merits of a number of proprietary and other preparations in the control of powdery mildew of cucumbers (*Erysiphe cichoracearum*) [*R.A.M.*, viii, p. 23]. The dusting materials used were grape dust (64 per cent. free sulphur), slug shot (6 per cent.), tricked sulphur (91 per cent.), Anchor sublimed velvet flowers of sulphur (practically 100 per cent.), and a sulphur gypsum dust prepared to contain 15 and 20 per cent. free sulphur and 80 to 85 per cent. gypsum, both of 200-mesh fineness. All these preparations gave very good control of the disease, but slug shot was less effective than the others in cool weather. The application of heavy doses of dusts with a high sulphur content causes injury to the plants. For houses of the dimensions 280 × 40 ft. not more than 5 to 6 lb. of dust should be used at a time, the material being discharged into the air above the vines and allowed to settle before the ventilators are opened.

The most satisfactory equipment for the application of vaporized sulphur was found to consist of electric hot plates, and rates of 1½ to 9 lb. per 100,000 cu. ft. were tested. Equal control of epiphyllous infection was secured with all doses, but in no case was the mildew eradicated from the sheltered foliage and lower leaf surfaces. In bright, warm weather this method of treatment gives fairly complete disinfection of the foliage, and the distribution of the sulphur is more uniform by vaporization than by dusting.

In a series of tests on the comparative efficacy of various liquid fungicides, Bordeaux mixture 1–1–100 and 2–2–100 gave consistently good results, while the 4–4–100 mixture left a heavy residue and caused a hardening of the foliage. Satisfactory control was also obtained with basic copper sulphate prepared by Holland and his collaborators [ibid., vi, p. 175], containing 26 per cent. copper, Hammond's copper solution (3·05 per cent.), Dow powdered Bordow (12·5 per cent.), and Grasselli Bordeaux mixture powder (13 per cent.). Copper sprays are valuable during cool, dull weather when sulphur is ineffective.

Dilutions of lime-sulphur from 1 in 200 to 1 in 1,000 were fungicidal, but the stronger ones left an objectionable residue on the cucumbers. Potassium sulphide at 1 in 400 to 1 in 1,000 destroyed the mildew without any adverse effects on the plants. Dry-mix sulphur lime (2, 3, and 4 per cent.) was safe, but its use is considered undesirable on account of the spray residues left on the fruit.

In a series of experiments in the combined control of mildew and red spider (*Tetranychus telarius*), it was found that Volck

lubricating oil is not compatible with any of the sulphur fungicides except slug shot and the low-grade sulphur dusts. It may, however, be combined with Bordeaux 1–1–50 or proprietary preparations diluted to contain an equivalent amount of copper.

BEACH (W. S.). **The relations of Bacterium vignae to the tissues of Lima Bean.**—*Pennsylvania Agric. Exper. Stat. Bull.* 226, 14 pp., 1 pl., 1 fig., 1928.

A full account is given of the author's investigations on the changes produced in Lima beans [*Phaseolus lunatus*] by artificially induced attacks of *Bacterium vignae* [*R.A.M.*, v, p. 401], and the mode of migration of the organism through the invaded tissues.

Most of the data are based on an examination of pod material, in which it was found that, when attached to the plants, invasion was usually discernible 18 to 20 hours after inoculation. The approximate average rate of progress of the organism through the cortical tissues was estimated at 65 μ per hour, a marked increase occurring at temperatures of 85° F. or above as compared with 65° to 70°. The bacteria made the greatest advance near the epidermis, and in a midway zone occupied by the vascular bundles. In some cases the long parenchyma cells running parallel with the tracheae may be wedged apart or filled with bacteria for some distance along a bundle, but only exceptionally were the organisms observed within the tracheae. Invasion of the succulent pith layer lying next to the seeds was also unusual, while the parasite made scarcely any headway in the supporting layer of elongated, close-fitting cells situated between the cortex and the succulent pith in the pod wall. Preliminary observations on infected leaves indicated that invasion was most rapid through the spongy tissue, and that the parasite very probably enters through the stomata.

The first sign of bacterial activity is the development of zoogloeae along the line of puncture. The second step in the infective process is the advance of the zoogloeae along the intercellular spaces between uninjured cells. Side pressure against the cell walls does not become apparent until the bacteria multiply, when the cells are wedged apart and ultimately surrounded. Schizogenous cavities are formed and may unite. In the intercellular spaces, the tips of the zoogloeal masses are convex in the region near the margin of invasion or in material fixed about 24 hours after inoculation. At the advancing margins the matrix material is often relatively considerable and the bacteria comparatively few.

The first effects of parasitism are usually apparent somewhat behind the limits of invasion, where a reaction of the host cells resembling plasmolysis may be observed. Subsequent changes consist of disintegration in the plastids and along the plasma membrane. The nucleus is apparently the last part of the protoplast to show any modification. The protoplast may be partially disintegrated without the bacteria gaining entrance to the cell cavity, indicating the diffusion of bacterial enzymes through the walls. This process is usually confined to the region considerably behind the margin of invasion, and is particularly noticeable where there is a large intercellular accumulation of bacteria, but is sometimes visible in the uninvaded tissue for a distance of one or two

cells. The bacteria eventually enter the lumina of a considerable number of cells, this process apparently being assisted both by mechanical pressure and the disintegration of the cell walls, but in general the cell walls seem to undergo no great change as a result of the invasion. The apertures affording ingress to the lumina are usually small, and the lysigenous cavities few and not extensive. Most of the cells in which the lumina were invaded were found to have thin walls.

An important point indicating that *Bact. vignae* may have a life-cycle analogous to that described by Nixon for *Bacillus amylovorus* [see below, p. 249] is the gradual change of size and form of the rods. The average length of *Bact. vignae* in the vegetative stage (8 to 25 hours old) was 1·7 μ (range 0·9 to 2·2 μ), while in the reduced or dormant form (after 7 to 10 days), the average length was 0·8 μ (range 0·5 to 1 μ). In the latter phase the organisms are frequently arranged in pairs of two very short rods or spheroidal bodies, probably representing a last fission of the actively dividing stage.

MATSUMOTO (T.). **Beobachtungen über Sporenbildungen des Pilzes Cercosporina kikuchii.** [Observations on spore formation in the fungus *Cercosporina kikuchii.*]—*Ann. Phytopath. Soc. Japan*, ii, 2, pp. 65–69, 1928.

In the author's previous investigations on *Cercosporina kikuchii*, the causal organism of purple speck of soy-beans [erroneously listed as *Cercospora kikuchii* in *R.A.M.*, iv, p. 714: see also ibid., vii, p. 18], great difficulty was experienced in securing profuse conidial formation for observation. In a recent series of experiments with diseased beans kept in damp Petri dishes, the optimum temperature for this process was found to be between 15° and 20° C. At 20° to 25° the conidia rapidly developed into mycelium. Conidia were sometimes observed on the inner surface of diseased pods collected during the harvest, as well as on infected cotyledons, either attached to the plant or already shed. Potato dextrose agar was found to be a suitable medium for conidial production, though not so good for mycelial development. True chlamydospores, quite distinct from the hyphal cells resembling these organs [loc. cit.], were formed on diseased pods in the thermostat at 25°. They are approximately spherical, 5 to 8 μ (sometimes up to 12 μ) in diameter, and with an orange-yellow membrane, 0·85 to 1·30 μ thick.

YOSHII (H.) & TAKIMOTO (S.). **Bacterial leaf blight of Castor Bean.**—*Journ. Plant Protect.*, xv, pp. 12–18, 1928. [Japanese, with English summary.]

A bacterial leaf blight of castor bean [*Ricinus communis*] is prevalent in Korea and Kyushu, Japan. The affected leaves at first show numerous, irregular, brown, water soaked lesions, mostly 2 to 5 mm. in diameter, followed by laceration and premature defoliation. No wilting of the affected plants occurred either in the field or in artificial infections.

The causal organism, *Bacterium ricini* n. sp., is a short non-sporing rod with rounded ends, occurring singly, in pairs, or in short chains, 0·4–0·9 by 1·3–2·6 μ in diameter, unipolar flagellate,

strictly aerobic, with capsules, Gram-negative, and non-acid-fast. The colonies on nutrient agar are lemon-yellow, then brown, gradually changing to medium brown; gelatine is liquefied, casein peptonized without coagulation, litmus milk becoming slightly acid, then reduced. Acid is formed from lactose, no gas is produced, nitrates are not reduced, and there is a strong diastatic action. The organism makes a feeble growth in Uschinsky's solution, but none in Cohn's. Its thermal death point is 50° to 51° C. (maximum 39°, optimum 29° to 30°, and minimum about 2·5°).

YOSHII (H.). **The bacterial spot of Pepper.**—*Journ. Plant Protect.*, xv, pp. 434–438, 1928. [Japanese, with English summary.]

The bacterial spot of pepper (*Capsicum annuum*) has been studied by the author at the Agricultural Experiment Station, Korea, since 1925. The general symptoms of the disease resemble those reported by Higgins from Georgia, U.S.A., and the morphological, cultural, and physiological characters of the organism isolated from the affected plants approximate closely to *Bacterium vesicatorium* [*R.A.M.*, iii, p. 119] as in America. Successful inoculations were carried out on the leaves, stems, and fruits of pepper and tomato.

VIALA (P.). **Nouvelles observations sur l'esca.** [New observations on the 'esca' disease.]—*Rev. de Vitic.*, lxviii, 1765, pp. 265–269; lxix, 1789, pp. 229–235, 7 figs., 1928.

In continuation of his detailed studies [*R.A.M.*, v, p. 592] of the morphology and biology of *Stereum necator* (which he still regards as distinct from *S. hirsutum* [cf. ibid., vi, p. 711], the latter being a pure saprophyte which he has never found on the vine), the author states that in 1927 he found endoconidial fructifications of the fungus in large numbers on diseased vine stocks in Champagne. These fructifications, which had not hitherto been observed in nature, were analogous to those that are formed in pure cultures. They consisted of semi- or non-resupinate, leathery sporophores of very variable size (sometimes 4 or 5 times the size of the basidial sporophores), of a dirty greyish-yellow colour on the villous side and brownish-yellow on the fruiting surface, which was pierced with numerous regular pores. The inner surface of the tubes was lined with sterile hyphae and others containing spherical or subovoid, hyaline endoconidia, from 1 to 5 μ in diameter.

In 1926 and 1927 the incidence of the apoplectic form of the 'esca' disease in the south of France was noticeably reduced, presumably owing to the exceptionally dry weather of July and August in both years, but the progressive form, presenting symptoms that have many points in common with the so-called 'court noué' [ibid., viii, p. 13], was fairly common. In this form numerous infection foci of irregular shape, surrounded by a brown zone, and occasionally connected with an infected pruning scar by a narrow strand of mycelium from 1 to 3 cm. in diameter, occur within the branches, especially in the region of the pith at the junction between stock and scion in old grafted vines. The frequent association of such infection foci with symptoms resembling 'court noué'

suggests that *S. necator* diffuses a toxin which exerts a stunting effect on the aerial organs far in advance of the mycelium.

The author states that in 1927 he received diseased vine stocks from the Argentine and Chili, which presented typical symptoms of the apoplectic form of the disease. Although the mycelium which permeated the inner tissues could not be identified, there is little doubt that this forms the first record of the disease in South America.

[An outline of this paper was published in *Comptes rendus Acad. d'Agric. de France,* xiv, 17, pp. 613–615, 1928.]

RAVAZ (L.). **L'excoriose. Attention à la taille.** [Excoriosis. Pay attention to pruning.]—*Prog. Agric. et Vitic.*, xc, 43, pp. 391–393, 1928.

In view of the severe recrudescence of the excoriosis disease of the vine (*Phoma flaccida*) [*R.A.M.*, vii, p. 762], which was reported from many parts of France during 1928, the author recommends that great care should be taken not to utilize shoots which are fissured at the base for the purpose of providing the bearing shoots of the following year. All such shoots should be pruned off in November or December to remove infected material, and the vines sprayed with Bordeaux mixture (4–2–100) or 3 to 4 per cent. copper sulphate; alternatively, an application of acid Bordeaux mixture should be given in spring, before the opening of the buds.

The disease, which is favoured by damp conditions, varies in intensity each year. Carignan, Picpoul, and Aspiran vines are less susceptible than Aramon.

MUTH. **Die Melanose der Amerikanerreben.** [Melanose of American Vines.]—*Mitt. Deutsch. Landw. Gesellsch.*, xliii, 47, pp. 1063–1066, 1928.

The occurrence of melanose (attributed by Kirchner to *Septoria melanosa* Elenk. and by other authors to *S. ampelina*, but now considered to be due to physiological causes) on American vine stocks is stated to produce deleterious effects on the wood, which must, as far as possible, be counteracted by selection.

The leaves of affected vines show numerous punctiform, livid brown spots, 0·5 to 1 mm. in breadth, on both surfaces, mostly between the larger veins. The spots are darker on the upper than on the under side. This form of the disease, known as 'dot melanose', is prevalent on the Riparia 1 Geisenheim variety. In the so-called 'spot melanose' the brown dots rapidly expand into broad lesions involving a large portion of the leaf tissue which becomes brown and brittle (except for the midribs and principal lateral veins). The remaining green portions of the leaf turn yellow, and eventually it falls. The typical symptoms of this more severe form of melanose occur on the Riparia × Rupestris 108 M.G. At first only fully developed leaves are attacked, but in the autumn, when the vigour of the shoots abates, the younger ones may also be affected. The disease is favoured by persistent cool and damp weather, especially following dry, fair conditions. At such times the lower leaves may be attacked with sufficient

severity to cause defoliation, the young leaves at the tips of the shoots alone surviving.

The primary cause of melanose is believed to be transpirational disturbances effected by shading, or by interference from tying up operations. In 1906 and 1908 the writer observed that the foliage of a *Vitis rupestris* stock subject to these influences was much more heavily damaged than the leaves of shoots swinging freely in the wind.

The same conditions that cause the development of intumescences on European vines lead to the appearance on American varieties of the typical symptoms of melanose. These differences in the reaction of the two groups are apparently correlated with the constitution of their epidermal cells, as is also the greater susceptibility of European than American vines to injury from Bordeaux mixture.

The results [which are tabulated] of a series of varietal tests at Berncastel-Cues (Rhine) indicate that the reaction resulting in melanose is not a stable character, but that it fluctuates considerably under different environmental conditions. Among the more susceptible varieties are Riparia × Rupestris 3309 C., Cordifolia × Rupestris 17 G., Rupestris × Berlandieri 301^{A} M.G., Aramon × Riparia 143^{B} M.G., Aramon × Rupestris 1 Gz, and Riparia × Rupestris 13 G.

McRae (W.). **Report of the Imperial Mycologist.**—*Scient. Repts. Agric. Res. Inst., Pusa, 1927–8*, pp. 56–70, 1928.

The study of the influence of fertilizers on the incidence of pigeon pea wilt (*Fusarium vasinfectum*) was continued [*R.A.M.*, vii, p. 302]. In general the results observed in the permanent manurial series of plots agreed with those of previous seasons, except that the plot receiving green manure and superphosphate contained a very high proportion of wilted plants (33·8 per cent.). During the last two seasons the incidence of wilt in this plot has exceeded the highest degree of infection observed in those treated with superphosphate only. Previous data suggested that superphosphate favours the development of wilt, and green manure impedes it, the combined action of both producing an intermediate effect. However, the data for the last two seasons indicate the operation of some other factor as a dominant influence in favour of the wilt.

A comparison of a culture of the species of *Phytophthora* responsible for a disease of *Piper betle* in the Madras Presidency with that isolated from Bengal material [ibid., viii, p. 156] showed a great similarity between the two.

A species of *Phytophthora*, isolated from dying cinchona seedlings, is characterized by sporangia measuring 30 to 79 by 21·6 to 45 μ (average 52 by 33 μ), a large and prominent papilla, and chlamydospores 38 μ in diameter.

A leaf disease of *Cicer arietinum*, caused by a species of *Mystrosporium* with single, ovate, muriform conidia measuring 13 to 33 by 9 to 26 μ (average 22 by 19 μ), was observed for the first time at Pusa after a spell of wet, misty weather during January and February.

The current season's inoculations with the *Fusarium* from Assam failed to cause complete sterility of rice [ibid., vii, p. 303]. A species of *Cephalosporium* isolated from Punjab rice plants killed seedlings and caused a collar rot of mature plants.

The smut of *Paspulum scrobiculatum* due to *Sorosporium paspali* has been reduced from about 50 to under 1 per cent. by steeping the seed in copper sulphate or dusting with copper carbonate [ibid., vii, p. 304].

The occurrence of *Plasmodiophora brassicae* on cabbage and cauliflower was reported for the first time in India.

Report of the Director for the year ending October 31, 1927.—*Fifty-first Rept. Connecticut Agric. Exper. Stat. for the year 1927* (*Bull.* 291), pp. 91–111, 10 figs., 1927. [Received January, 1929.]

The following items of phytopathological interest occur in this report. During the period under review, 159,121 wild, and 2,235 cultivated *Ribes* were destroyed over an area of 20,904 acres as part of the campaign against white pine blister rust [*Cronartium ribicola*: *R.A.M.*, vii, p. 815].

The active principle of tobacco mosaic was found in 1926 to be still viable in leaves that had been dried and preserved for 24 years. Inoculation experiments with this material gave positive results.

The best control of apple scab [*Venturia inequalis*] was given by kolodust [ibid., vii, p. 565], but the complete spray schedule proved more effective against sooty blotch [*Phyllachora pomigena*] and fly speck [*Leptothyrium pomi*].

VAN DER GOOT (P.). **Ziekten en plagen der cultuurgewassen in Nederlandsch-Indië in 1927.** [Diseases and pests of cultivated crops in the Dutch East Indies in 1927.]—*Meded. Inst. voor Plantenziekten*, 74, 85 pp., 1928.

This report, prepared on the usual lines [*R.A.M.*, vii, p. 307], contains numerous references of phytopathological interest, of which the following may be mentioned. *Arachis* [*hypogaea*] was severely attacked by an obscure disease, probably caused by a *Sclerotium*, and characterized by a yellow discoloration of the plants and the occurrence of holes in the fruit wall, with consequent rotting of the pods.

'Mentek' disease (root rot) of rice [ibid., i, p. 20; ii, p. 8] occurred over a considerably wider area in 1927 than in 1926 in the Soerakarta Residency (548 compared with 155 hect.). On the other hand, in the Demak district of Semarang, where 1146·8 hect. were affected in 1926, the wet season rice crops suffered from mentek only in badly drained sites during 1927. The dry season crop was more severely attacked, apparently owing to a spell of drought in July, preceded by a heavy rainfall in May and June. The disease was also reported from other districts, e.g., the Menado Residency, where the annual damage from this source is very heavy. Infection by *Pythium* was observed on rice crops cultivated under dry conditions in Bodjonegoro (Rembang).

Slime disease of potatoes [*Bacterium solanacearum*] caused

heavy losses in the Pasoeroean district of Java and on the east coast of Sumatra.

Coco-nut palms in Soerabaja and Madoera were seriously affected by an abnormal shedding of the young fruits, presumably due to meteorological factors, as no parasitic organism could be detected in the diseased material.

Oil palms [*Elaeis guineensis*] in Java were killed by a stem rot with which a bacterium was constantly associated. It is not known whether this organism actually causes the disease.

The yield of djeroek [citrus] groves in Madoera is stated to be decreasing as a result of the so-called 'foam' disease, the cause of which is unknown [ibid., vii, p. 629]. In Pasoeroean the same host was severely damaged by gummosis, the symptoms of which constantly recur even after the excision of the diseased areas and their treatment with Bordeaux mixture or tar. Root rot, caused by a species of *Fusarium*, was prevalent on citrus seedlings in nurseries.

Teak [*Tectona grandis*] trees on Kangean island suffered from an obscure die-back beginning at the crown and gradually involving the entire tree. The symptoms have only been observed on old trees on low-lying ground along the coast. A fungus was isolated from diseased branches, but is not believed to be responsible for the disturbance, which may be due to soil conditions.

The chief disease of *Hevea* rubber in Sumatra is stated to be white root rot [*Fomes* sp., formerly known as *F. lignosus*: ibid., viii, p. 72]. Mouldy rot of rubber [*Ceratostomella fimbriata*] was reported from various parts of Sumatra, sometimes in a severe form. The so-called 'lump canker' of the renewing bark caused severe damage on a limited number of trees on some of the Besoeki estates. The tapping surface may be completely destroyed unless preventive measures—excision of the cankers and application of a preservative—are rapidly adopted. In central Java the red root fungus (*Ganoderma pseudoferreum*) attacked both young and old plantations. The death of rubber stumps as a result of infection by *Botryodiplodia theobromae* was reported from one estate.

The E.K. 28 and D.I. 52 varieties of sugar-cane suffered severely from sereh disease in various parts of Java. P.O.J. 2878 is no less susceptible to Java gum disease [*Bact.* sp.] than the old varieties, but it is apparently immune from root rot and has been widely used to replace the susceptible E.K. 28. On the whole P.O.J. 2878 seems rather more susceptible to fungous diseases than the old varieties, being attacked with some severity by pink disease [*Corticium salmonicolor*], *S. rolfsii*, and *Cercospora kopkei* [ibid., ii, pp. 109, 525].

Stem scorch of tobacco (*Pythium*) [*de Baryanum*, *P. aphanidermatum*, and other species], occurred in at least 43 of the Deli estates [ibid., vi, pp. 444, 446], where heavy losses were sustained. The disease was most prevalent on low-lying, waterlogged soils, and on those planted with *Leucaena glauca* as a green manure.

Patchouli [*Pogostemon comosus*] in the Atjeh Residency of Java was very generally affected by an obscure disease, characterized by the development of innumerable minute pustules on the stems and by curling of the leaves.

Annual Report of the Acting Director of the General Experimental Station of the A.V.R.O.S., 1st July 1927–30th June 1928.—*Commun. Gen. Exper. Stat. A.V.R.O.S., Gen. Ser.* 34, 41 pp., 1928.

The following items of phytopathological interest occur in this report. White root disease of *Hevea* rubber (*Rigidoporus microporus*) [*Fomes* sp.: *R.A.M.*, viii, p. 72] was again very troublesome in older plantations. The sole method of control is stated to be the periodical examination of the root collars every one or two years, accompanied by treatment where necessary. A progressive increase of patch canker (*Phytophthora faberi*) [*P. palmivora*] in rubber estates has been observed of recent years. One-year-old rubber trees in four different places were affected by an apparently non-parasitic die-back of the tops.

Oil palms were attacked by white root disease caused by the above-mentioned *Fomes*, the thick mycelium of which was found spreading over the axils of the leaf bases. The soft tissues in the centre of the trunk develop a wet rot as a result of infection; the remaining fibrous tissue has the characteristic odour of butyric acid. The fructifications of the fungus occurred in large numbers on dying palms at the end of the rainy season (December, 1927). Direct control measures would probably be too expensive and the prevention of the disease should be based on thorough sanitation of the estates.

DADE (H. A.). **Ceratostomella paradoxa, the perfect stage of Thielaviopsis paradoxa (de Seynes) von Höhnel.**—*Trans. Brit. Mycol. Soc.*, xiii, 3–4, pp. 184–194, 3 pl., 1928.

A detailed description is given of certain sphaeronemoid bodies which were found associated with *Thielaviopsis paradoxa* on cacao husks in the Gold Coast. These proved in reality to be perithecia with very fugitive asci, and cultural experiments proved their genetic relationship with *T. paradoxa*. The perithecia are flask-shaped, with a hyaline or light-coloured spherical bulb, 200 to 350 μ in diameter, immersed or almost immersed in the substratum, and with a black, shining beak, 800 to 1,200 by 30 to 40 μ, with a fimbriate apex. On the upper part of the bulb very characteristic appendages with stellate-coralloid apices are borne. The asci are clavate and stipitate and their size depends upon the period of persistence. The ascospores are irregularly biseriate, or, later, indefinitely arranged. They are elliptical, frequently more convex on one side, 7 to 10 by 2·5 to 4 μ. The fimbriate top opens to support the spore mass, which is translucent and pearly in colour, later yellow, the spores being held together by the fatty substance produced in the asci. The ascospores do not germinate in water, but rapid germination was obtained in hanging drops composed of juice from the mucilaginous tissue surrounding the cacao beans. Cultures obtained from single ascospores only produced conidia, with the exception of one abnormal vegetation which produced bodies resembling the bulbs of the perithecia and containing spores terminally on fertile hyphae. By culturing the normal vegetations in pairs it was shown that the fungus is heterothallic, but the two sexual strains exhibited no differences in morphology or

behaviour in culture. The organism is referred to the genus *Ceratostomella* and is named *C. paradoxa*, with a Latin diagnosis.

MILLASSEAU (J.). **Note préliminaire sur une maladie bactérienne du Blé.** [A preliminary note on a bacterial disease of Wheat.] —*Rev. Path. Vég. et Ent. Agric.*, xv, 9, pp. 279–284, 1 pl., 1 fig., 1928.

A description is given of the symptoms of black chaff of wheat (*Bacterium translucens* var. *undulosum*) which during 1928 was prevalent in the vicinity of Paris and in Brie, and was also found in the south-west of France. Furthermore, the author was informed by Ducomet that the latter had noticed it in Brittany in 1913 and at Grignon in 1916.

The disease is considered to have been introduced from America; under French conditions it differs, however, from the American descriptions in that no leaf symptoms or bacterial exudate were observed and shrivelling of the grain was uncommon.

The following varieties showed marked infection: Hérisson Barbu, Bordeaux rouge, Hybride Inversable, Rouge d'Alsace with all its hybrids, Japhet, Bordeaux, Hérisson and its selections, Ardito and its hybrids, and Engrain.

In 1927 some F_2 lines of Inversable Bordeaux showed infection while others did not, and this character was retained in the F_3 when they were sown side by side the following year.

The paper terminates with brief notes on seed disinfection.

Barberry eradication.—*Third Bienn. Rept. Michigan Dept. of Agric. for the fiscal years ending June 30, 1927 and 1928*, pp. 25–27, 1928.

A brief, popular account is given of the relationship between the common barberry and the development of stem rust [*Puccinia graminis*] on cereals in Michigan, where 668,007 barberry bushes have been destroyed since the inception of the campaign of eradication in 1918 (100,000 in 1927). The amount of common salt [*R.A.M.*, vi, p. 283] used for the extermination of the bushes during the whole campaign was over 435 tons (170 in 1927).

MILAN (A.). **Contributo allo studio della biologia di Tilletia tritici e Tilletia laevis.** [A contribution to the study of the biology of *Tilletia tritici* and *Tilletia levis*.]—*Nuovi Ann. Agric.*, viii, 1–2, pp. 3–24, 1928.

A detailed account is given of experiments conducted during 1926 and 1927, in which wheat seedlings of various named varieties were wounded by a needle-prick at the base of the culms or by being broken off near the roots, and were exposed to infection by *Tilletia tritici* and *T. levis* [*R.A.M.*, vii, p. 151], others being exposed to similar infection without wounding. The results obtained [which are tabulated and fully discussed] were briefly as follows.

The control plants not exposed to infection remained free from bunt, as did also those exposed to infection without wounding, while the wounded plants became more or less severely infected. The infected ears were most numerous on the lower tillers, which developed late in the plants' growth, and it is suggested that the

smut spores were only able to penetrate by their germ-tubes when the latter came into contact with the buds, the green, adult culms not being susceptible to wound infection. Surface applications of germinating spores to the sheaths and leaf blades produced no effect. When the culms were broken off near the roots many plants became infected, infection appearing largely to depend upon the nearness of the wound to the point of emission of the young shoots. Insect injury may facilitate infection by breaking the tissue and exposing the new shoots to the fungus in the soil.

The author concludes that wheat can become infected with bunt when the spores are present in the tissues at the base of the culms during the growing period of the host. Normally the leaf sheaths and other green parts serve to protect the young shoots, and infection is impossible unless this protection is broken down. It is suggested that this method of securing infection by wounding can be used with advantage in investigations of the relative resistance of varieties of wheat to bunt.

PELTIER (G. L.). **Control of bunt of Wheat in Nebraska.**—*Phytopath.*, xviii, 11, pp. 921–929, 1928.

The results of a series of tests in the control of wheat bunt [*Tilletia levis*] conducted from 1923 to 1927 at two localities in Nebraska are discussed and tabulated. The following compounds were used: copper carbonate, corona coppercarb, copper stearate, colloidal copper, jabonite, semesan, Bayer dust, corona 40-S, corona-620, seed-o-san (white), seed-o-san (pink), and formaldehyde. All the dusts were applied at the rate of 2 oz. per bushel, while formaldehyde was used at a concentration of 1 in 320 (15 minutes' immersion). The wheat seed-grain (Nebraska No. 60, a uniform strain of Turkey) was inoculated with the spores of the fungus (5 gm. per 100 gm. of wheat). Formaldehyde was found to be the most effective treatment under all conditions, but it consistently reduced germination. Copper carbonate was the most efficacious of the dusts. The value of all the treatments appears to be lessened in varying degrees under environmental conditions favouring the development of bunt (principally soil temperatures below 20° C.).

TERÉNYI (A.). **Laboratoriumsuntersuchungen mit dem 'Germisan-Kurz-Beizverfahren'.** [Laboratory experiments with the germisan short disinfection process.]—*Fortschr. der Landw.*, iii, 21, pp. 972–973, 1928.

After referring to Gassner's experiments in the disinfection of seed-grain with small amounts of liquids [*R.A.M.*, vi, p. 278], the writer describes his laboratory experiments with the germisan short disinfection process [ibid., vii, p. 153]. It was found that the concentrated germisan solutions (0·5, 0·75, 1, and 1·5 per cent.), used at the rate of 6, 4, 3, and 2 l., respectively, per 100 kg. of seed-grain, caused no reduction of germinative energy and capacity. The fungicidal action of germisan at the above rates and concentrations is entirely satisfactory where the wheat seed-grain is not very heavily infected by bunt [*Tilletia tritici* and *T. levis*] (not more than 0·1 per cent. by weight of bunt spores).

Guyot (A. L.). **De l'action de quelques désinfectants de la semence contre la carie du Blé (Tilletia caries).** [On the action of some seed disinfectants against bunt of Wheat (*Tilletia caries*).]—*Rev. Path. Vég. et Ent. Agric.*, xv, 8, pp. 249–255, 1928.

In this paper the author gives the results of experiments made in 1926–7 on the disinfection of wheat seed artificially contaminated with bunt (*Tilletia caries*) [*T. tritici* and *T. levis*]. Complete control was given by dusting with neutral copper acetate (5 gm. per kg. of seed) [*R.A.M.*, vii, p. 624], or by immersion in 0·25 per cent. mercuric chloride for 30 minutes, in a commercial mixture of mercuric chloride and copper sulphate of 0·125 per cent. strength for 30 minutes, in 0·1 per cent. commercial formalin for 1 hour, or 0·25 per cent. for 30 minutes, and in a preparation containing sodium cyanomercuricresolate (0·25 per cent. strength) for 30 minutes. The efficacy of copper sulphate solution varied, but was most marked when immersion was prolonged; the liming of seed which had been immersed for 2 hours in 1 per cent. copper sulphate led to increased infection as compared with seed similarly immersed but not limed.

Hieke (F.). **Einfluss der Düngung auf die Fusskrankheiten des Getreides.** [Influence of manuring on the foot rots of cereals.] —*Ernährung der Pflanze*, xxiv, 22, pp. 411–412, 1928.

In an experiment to determine the efficacy of various fertilizers on the control of foot rot of wheat (*Ophiobolus herpotrichus*) [*R.A.M.*, vii, p. 626], the best results were given by top dressings of ammonium sulphate (120 kg. per hect.) or calcium nitrate (150 to 200 kg. per hect.), combined with 150 kg. of 40 per cent. potash salts.

Fellows (H.). **The influence of oxygen and carbon dioxide on the growth of Ophiobolus graminis in pure culture.**—*Journ. Agric. Res.*, xxxvii, 6, pp. 349–355, 1 fig., 4 graphs, 1928.

Details are given of experiments in which pure cultures of *Ophiobolus graminis*, the causal organism of the take-all disease of wheat [*R.A.M.*, vii, p. 701], on potato-dextrose agar and potato-dextrose decoction were grown in atmospheres of varying concentrations of oxygen and carbon dioxide, to test the effect of these gases on the growth of the fungus. On both media growth occurred at all the concentrations of oxygen used, but in the liquid medium the growth diminished gradually as the concentration decreased; on the solid medium, marked diminution did not occur until the concentration of oxygen was below 6 per cent. The fungus grew well on both media when the carbon dioxide concentration was varied, although at the highest concentration used, 18·02 per cent., some diminution of growth was noted. It is therefore believed that the variations in these gases which occur in arable soils are not great enough to affect to any appreciable degree the growth of the fungus in nature.

Neumann. **Massnahmen gegen das Schimmeln des Brotes.** [Precautions against mouldiness of bread.]—*Mitt. Gesellsch. Vorratsschutz*, v, 1, pp. 16–17, 1929.

In this paper (reprinted from *Zeitschr. für das gesamte Getreide-*

wesen, xv, 9, 1928), the writer gives brief directions in popular terms for the prevention of mouldiness in bread, which, he points out, is due to external contamination, as the heat of baking is sufficient to destroy the spores of the common bread moulds if the flour is properly dried. Care should be taken to avoid the development of cracks in the crust, through which the mould spores can gain access. The use of impermeable paper for wrapping bread may increase condensation and thus provide sufficient moisture for the development of fungi. In bakeries where infection of this type is prevalent salicylic acid (0·6 gm. per l.), nipagin (a benzoic acid compound), animallin, mikrobin, or similar preparations may be added to the water used for coating the bread after baking.

MACKIE (JANE R.). **Localization of resistance to powdery mildew in the Barley plant.**—*Phytopath.*, xviii, 11, pp. 901–910, 3 figs., 1928.

Of recent years the Californian barley crop has suffered severely from powdery mildew (*Erysiphe graminis*), and an inquiry was accordingly made into the nature of varietal resistance to this fungus, with a view to breeding or selection for immunity.

Affected plants turn yellow, except for the areas immediately surrounding the invaded epidermal cells, which remain green for some time. This discoloration of the entire plant, which is accompanied by stunting, strongly suggests the secretion by the fungus of a toxic substance. Maturity is delayed and the heads contain numerous poorly developed kernels, the germ region being sometimes darkened.

Experiments [details of which are given] to determine the relative susceptibility to *E. graminis* of eight varieties of barley, viz., Atlas, Sacramento, Hero, Chile, Goldfoil, Hanna, Oderbrucker, and Common Chile, showed that Atlas and Hanna were very susceptible, Hero, Oderbrucker, and Chile less susceptible, Common Chile resistant, and Sacramento and Goldfoil highly resistant.

No morphological peculiarities in the resistant varieties could be detected. When inoculations were made on the exposed mesophyll, resistance was consistently broken down, this process being accompanied in most cases by the development of an internal mycelium.

In no case was the fungus seen to enter at a stoma, though the mycelium commonly passed across the opening and haustoria occurred in the epidermal cells on either side.

The relative resistance of the varieties appeared to be quite stable under the conditions of the experiments.

GENAU (A.). **Methoden der künstlichen Infektion der Gerste mit Helminthosporium gramineum und Studien über die Anfälligkeit verschiedener Sommergersten diesem Pilz gegenüber.** [Methods of artificial infection of Barley with *Helminthosporium gramineum* and studies on the susceptibility of various summer Barleys to this fungus.]—*Kühn-Arch.*, xix, p. 303, 1928. [Abs. in *Fortschr. der Landw.*, iv, 1, pp. 22–23, 1929.]

In a series of experiments extending over a period of three years at the Halle Agricultural Institute the author investigated

the biology of stripe disease of barley (*Helminthosporium gramineum*) and tested several methods of inoculation for their reliability in determining varietal susceptibility. The mycelium in the infected grain was found to be viable after two years, whereas the conidia died within 3½ months. The inoculation of the flowers with conidial suspensions was most successful the day following opening, when the temperature was about 25° C. Young seedlings 1 to 2 cm. in height were readily infected by means of conidial suspensions in a sufficiently warm and humid atmosphere. In one experiment the plants were successfully inoculated with the ascospores of the fungus. No evidence was obtained of the existence of physiological forms of *H. gramineum*. In a test of varietal susceptibility comprising 59 types of barley, a Crimean two-rowed awnless barley and Heil's Franken were found to be immune; Australian early, Pflug's normal, Stadler's R. 40, and Hörsdorfer D.G. were resistant; while all the *erectum* and Chevalier strains were heavily infected. Among the four-rowed varieties, Capucin was immune and Heine's four-rowed, Tystofte of Korsby, and Wurla were resistant. The six-rowed summer barleys showed the most severe infection [cf. *R.A.M.*, viii, p. 165.]

IRELAND (J. C.). **Controlling influences in Corn rot problems.**— *Bot. Gaz.*, lxxxvi, 3, pp. 249–269, 2 figs., 1 graph, 1928.

From 1922 to 1927 the author conducted a series of greenhouse and field experiments at Chicago University, and later in Indiana and Oklahoma, to determine the influences of soils and chemicals (especially aluminium and iron) on the incidence of maize rots (associated with *Diplodia zeae*, *Fusarium moniliforme* [*Gibberella moniliformis*], *G. saubinetii*, *Rhizopus* spp., and *Cephalosporium acremonium*) [*R.A.M.*, vii, p. 777]. The results of these trials are discussed and the analytical data tabulated.

D. zeae was used in these tests as a typical agent of rotting. Practically disease-free maize seed was sown, after drastic sterilization, on sterile dextrose agar and subsequently transplanted to pots containing sterilized white sand, to which molecular solutions of magnesium sulphate, calcium nitrate, and potassium dihydrogen phosphate were added. Each variety of maize tested was represented by five pots, one of which was used as a control, a second inoculated with *D. zeae* at the cotyledonary node, a third treated with a 0·0005 M. solution of aluminium sulphate, a fourth with a 0·0005 M. solution of aluminium chloride, and a fifth with a 0·0005 M. solution of ferrous sulphate. At maturity the plants were air-dried and a quantitative estimation made of the amounts of aluminium and iron in the roots, nodes, and internodes [cf. *R.A.M.*, iii, p. 32; v, p. 762].

The stalks of the plants inoculated with *D. zeae* began to show the characteristic red and brown streaks within a week, little trace of difference in varietal susceptibility being apparent. The stalks treated with the above-mentioned solutions showed no sign of disease and made somewhat better growth than the controls.

During the period of the tests environmental conditions in Indiana were very favourable to maize cultivation, and no reduc-

tion in yield resulted from fungous infection in the experimental plots on river bottom sand. In Oklahoma, where the soil temperature approached the thermal death point of maturing maize (over 30° C. during July), the later varieties were practically destroyed by the heat, but this factor apparently caused no increased susceptibility to the attacks of the fungi. The application of Chile nitrate to the soil caused the development of severe root and stalk rotting associated with the presence of a bacterium, possibly that described by Rosen [as *Pseudomonas dissolvens*: ibid., ii, p. 158] in Arkansas. Limited applications of iron and aluminium salts not only cause no increase of susceptibility to fungous infection but are actually beneficial on clay soils, possibly in the capacity of flocculants. It was found that colloidal soils induce an extraordinary development of secondary roots in maize, thereby rendering them more susceptible to fungous infection, which usually occurs at the points where the secondary roots rupture the cortex. A large percentage of maize rots may be eliminated by flocculating the colloids in the soil.

UPPAL (B. N.) & MALELU (J. S.). **A preliminary report on experiments in the control of grain smut of Jowar (Andropogon sorghum).**—*Agric. Journ. of India*, xxiii, 6, pp. 471–472, 1928.

An experiment [details of which are given] was carried out to test the relative efficacy of various dusts in the control of sorghum smut (*Sphacelotheca sorghi*), which is stated to cause an annual loss exceeding two crores of rupees [about £1,500,000] in the Bombay Presidency alone.

Copper carbonate (53 per cent. copper) was found to be very effective in the control of the disease [cf. *R.A.M.*, vi, pp. 399, 414]. Two to four ounces of the dust per 60 lb. of seed gave complete control of infection for all spore loads except the heaviest (1 part of smut spores by weight to 250 parts of seed), while 1 oz. was sufficient for dosages of 1 in 1,000 or less.

Sulphur applied at the rate of 4 oz. per 60 lb. of seed gave practically complete control except for the heaviest spore load, while 3 oz. of the No. 1 grade (passed through a 100-mesh sieve) proved adequate for spore dosages of 1 in 750 or less. This preparation was not effectual at the rate of 1 or 2 oz. Sulphur No. 2 (passed through a 250-mesh sieve) controlled infection in the case of spore loads of 1 in 1,000 or less when applied at the rate of 2 oz. per 60 lb. Even when used at the rate of 4 oz. per 60 lb., the amount of sulphur required to treat sufficient grain for one acre costs less than one pie [about $\frac{1}{10}$ of a penny].

Copper sulphate No. 1 (a coarse powder) failed to control infection for any spore dosage even at the rate of 4 oz. per 60 lb. of seed. However, copper sulphate No. 2 (passed through a 200-mesh sieve) gave more promising results, 2 to 4 oz. being fully effective except for the heaviest spore load (maximum infection 6 per cent.). Used at the rate of 1 oz. per 60 lb. this preparation was also efficacious for spore loads of 1 in 1,500 or less.

The results of these tests show that the present system of im-

mersing the sorghum seed-grain in a 2 per cent. copper sulphate solution may well be replaced by dusting with one of the above preparations, of which sulphur is the cheapest and easiest to apply.

PORTER (R. H.), YU (T. F.), & CHEN (H. K.). **The effect of seed disinfectants on smut and on yield of Millet.**—*Phytopath.*, xviii, 11, pp. 911–919, 1928.

In the northern and north-eastern provinces of China, as well as in Manchuria, the important millet (*Setaria italica*) crop is liable to heavy damage by smut (*Ustilago crameri*). In the crop disease surveys of 1925 and 1926, the incidence of infection frequently amounted to between 10 and 25 per cent., while occasionally over 50 per cent. of the heads were smutted.

The results [which are tabulated] of a series of experiments at Nanking in the control of this disease on naturally smutted seed by various fungicides showed that formaldehyde (1 in 320), dry uspulun [tillantin R], copper carbonate, and dry tillantin B (all applied at the rate of 2 oz. per bushel) are about equally effective [cf. *R.A.M.*, vii, p. 576]. In no case, however, was the amount of infection reduced to below 2·6 per cent. as compared with 26·6 and 20·6 in the controls in 1926 and 1927, respectively. Liquid uspulun (3 gm. per l. of water) proved inadequate. On artificially infected seed the incidence of infection was reduced from 6·8 to less than 1 per cent. by dry tillantin B and tillantin R, tillantin trockenbeize (all at 2 oz. per bushel), liquid uspulun, and tillantin-höchst (3 gm. per l.).

On heavily infected seed all the treatments increased the yield (by from 1·7 to 11·7 bushels per acre). Tillantin R and B gave consistently larger increases in yield than copper carbonate.

Smut-free heads selected before harvest from a badly infected field produced a crop with 4·7 per cent. of diseased heads, i. e. 26·2 per cent. less than in the crop produced by seed from the same field collected after threshing.

FOURNEAU (L.). **Note sur une affection cryptogamique du Petit Mil (Panicum spicatum Roxb.) causée par un hyphomycète.** [Note on a cryptogamic disease of Pearl Millet (*Panicum spicatum* Roxb.) caused by a Hyphomycete.]—*Rev. de Bot. appliquée*, viii, 86, pp. 681–683, 1928.

Pearl millet (*Panicum spicatum*) [*Pennisetum typhoideum*] growing in Senegal was recently found to be severely affected by a disease of the inflorescence characterized by rather large lesions in which was a waxy stroma of a pale rose colour formed by a species of *Fusarium*. The species concerned is thought to be very probably *F. roseum* (*Gibberella saubinetii*). The affected inflorescences are deformed or modified to a remarkable degree; seedlings are also attacked and become chlorotic and stunted. [The latter part of the author's description agrees with the disease of this millet caused by *Sclerospora graminicola*, which is common in West Africa.]

REICHERT (I.) & PERLBERGER (J.). **Observation and investigation of seed bed diseases of Citrus trees in Palestine.**—Reprinted from *Yedeoth*, ix–x, 18 pp., 6 figs., 1928. [Hebrew, with English summary.]

Damping-off of citrus seedlings occurs over wide areas of Palestine in two forms, viz., root rot, characterized by the decay of the rootlets, peeling of the bark, and a slight yellow discoloration of the foliage followed by the death of the seedlings; and crown rot, in which the leaves begin to droop shortly before the death of the plants but do not turn yellow; a brownish girdle encircles the collar. The latter form primarily affects young seedlings, while older ones suffer mainly from root rot.

A *Rhizoctonia*, a *Fusarium*, and an *Alternaria* have been isolated from material attacked by both forms of damping-off. In the course of three years' observations, the first-named fungus was found 9 times in 5 different localities, the second 37 times in 17 places, and the third 16 times in 11. The *Fusarium* and the *Alternaria* were found both on sweet lemon and sour orange [*Citrus aurantium*] seedlings, while the *Rhizoctonia* occurred only on the former host.

In two inoculation experiments the *Rhizoctonia* caused a destructive rot of lemon seeds, none of which germinated. The fungus was reisolated from the rotten seeds. Conditions of high humidity and the presence of abundant organic material are stated to favour its development. Irrigation should, therefore, be restricted as far as possible, while no organic manure should be given. The soil of the seed-beds should also be disinfected.

Other hosts attacked by the *Rhizoctonia* in Palestine include pine (*Pinus* sp.), peas, *Eucalyptus* sp., asparagus, carrot, *Myrtus communis*, sweet potato, lettuce, cabbage, cucumber, watermelon, *Citrus limetta*, beet, tomato, *Carica papaya*, *Cucurbita pepo*, *Robinia pseud-acacia*, beans (*Phaseolus vulgaris*), potato, strawberry, apple, lupin, and spinach.

Two fungi, belonging to the genera *Alternaria* and *Macrosporium*, respectively, have been isolated from citrus seedlings affected by a wilting of the leaves, beginning with a brown discoloration of the margins and spreading over the entire surface.

REICHERT (I.). **On the investigation of Citrus diseases in Palestine.**—Reprinted from *Palestine Citrograph*, i, 11–12, 7 pp., 1928.

Popular notes are given on the following citrus diseases occurring in Palestine: gummosis (collar and brown rot), which causes losses of 5 to 50 per cent. and appears to be associated with a species of *Fusarium*; *Diplodia* gummosis and twig blight [*D. natalensis*: see next abstract]; wither-tip (*Colletotrichum* [*gloeosporioides*] and *Gloeosporium*); blast of nursery seedlings [*Pseudomonas citriputeale*: *R.A.M.*, vii, p. 628]; and various other disturbances occurring in the seed-bed, e.g., a damping-off (*Rhizoctonia* and *Fusarium* spp.) [see preceding abstract] and 'little leaf', which affects oranges and grapefruit to the extent of 5 to 30 per cent., causing the development of mottled foliage, short joints, and erect twigs.

The damage from fruit rots (*D.* [*natalensis*], *Penicillium digitatum*, and *P. italicum*) in 1928 (up to 15th December) is estimated at 8 to 100 per cent. [see next abstract].

REICHERT (I.) & LITTAUER (F.). **The decay of Citrus fruits in Palestine and its prevention.**—Reprinted from *Palestine Citrograph*, i, 8–9, 22 pp., 5 figs., 1928.

In this paper the writers give popular notes on the chief factors responsible for the decay of citrus fruits in Palestine and in transit, together with directions, based on personal observations and on a survey of the relevant literature, for the improvement of existing conditions [cf. *R.A.M.*, vii, p. 442].

The following diseases are briefly described: stem-end rot (*Diplodia*) [*natalensis*], considered to be one of the most serious troubles in Palestine and stated to be responsible for 8 per cent. loss in one experimental shipment; black pit (*Bacterium* [*Pseudomonas*] *citriputeale*); grey mould (*Botrytis*) [*cinerea*]; black rot (*Alternaria*) [*citri*]; anthracnose (*Colletotrichum gloeosporioides*); green mould (*Penicillium digitatum*); blue mould (*P. italicum*); and *Aspergillus* rot, which has hitherto been found only on picked lemons.

It is estimated that 54,352 of the 1,600,705 boxes (valued at ten shillings each) of Jaffa oranges exported during 1927–8 (3·4 per cent.) were entirely wasted. During 1921–2 and 1922–3 the losses from decay were even heavier (23·4 and 11·5 per cent., respectively).

Various factors contributing to the development of citrus rots are briefly discussed. Control should be based on sanitation in the grove; the provision of windbreaks; the application of Bordeaux mixture at stated periods; careful picking; removal of 'buttons' [cf. ibid., v, p. 361]; disinfection of the fruit with sodium hypochlorite (*California Citrograph*, x, pp. 417, 446, 1925), sodium bicarbonate, or borax [ibid., viii, p. 170]; and efficient methods of transit and storage.

Attention is drawn to the need for Government support in the work of sanitary inspection and for the co-operation of growers in carrying out the instructions given above.

SAVASTANO (G.) & FAWCETT (H. S.). **The effect of mixed inoculations of certain Citrus fruit-rotting organisms.**—Abs. in *Phytopath.*, xviii, 11, p. 949, 1928.

Inoculations were made on wounded orange and lemon fruits with mixed spore suspensions of two or more of the following citrus-rotting organisms, and the effects compared with those of each fungus used singly: *Penicillium italicum*, *P. digitatum*, *Aspergillus niger*, *Trichoderma lignorum*, *Oospora citri-aurantii*, *Pythiacystis* [*Phytophthora*] *citrophthora*, *Botrytis cinerea*, *Sclerotinia libertiana* [*S. sclerotiorum*], *Alternaria citri*, *Phomopsis californica*, *Diplodia natalensis*, and *Dothiorella ribis* [cf. *R.A.M.*, vii, p. 163]. Different lots of fruit were placed at a series of constant temperatures from 3° to 33° C. Some of the most important results were: (1) the selective effect of temperature in enabling one organism in a mixture to predominate in the production of decay;

(2) the depressing or accelerating action of given mixtures on the rate of decay as compared with that produced by the most rapidly advancing organism of the mixture when used alone; (3) the influence of given mixtures on the nature, colour, and consistency of the rot; and (4) the difference in temperature range, and in the optimum, maximum, and minimum temperatures of the various organisms for rate of decay during a given period. *O. citri-aurantii* in certain mixtures, especially with *P. digitatum*, caused a marked increase in the rate of decay, which was more than the sum of the rates due to the two organisms separately. The mixture of the two species of *Penicillium* produced a depressing effect except at the highest and lowest temperatures used. *B. cinerea* in certain mixtures also caused a retardation of decay as compared with that induced by the most rapidly progressing organism of the mixture.

KIDD (MRS. M. N.) & TOMKINS (R. G.). **An analytical study of the mortality of Orange fruits at various constant temperatures.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1927*, pp. 35–36, 1928.

In this study ten comparable samples of South African Valencia oranges were stored at temperatures of 25°, 15°, 10°, 5°, and 1° C., and at each temperature under two conditions of humidity [cf. *R.A.M.*, vi, p. 621]. It was found that the progress curve of mortality, under constant conditions, is sigmoid, as with apples. The species of fungus responsible for the death of the fruit depends partly on the temperature conditions, e.g., *Colletotrichum gloeosporioides* killed 20 per cent. of the fruit at 25° C., 3 per cent. at 10°, and none at lower temperatures. *Fusarium* spp. destroyed 20 to 25 per cent. at 15° and 10°, but at lower or higher temperatures these fungi did not cause active disease. *Penicillium italicum* was most destructive at 5°, but *Alternaria citri*, which was the chief cause of fungal decay, was not noticeably affected by temperature.

At 5° and 1°, especially towards the end of storage, two types of physiological breakdown occurred; one (most pronounced at 5°) was marked by the collapse and browning of small, irregular, surface areas, while the other (most frequent at 1°) took the form of a pale brown discoloration of the whole surface, or large portions of it, the flesh appearing as if waterlogged and having a disagreeable odour.

Of the total fungal rotting, 60 to 80 per cent. originated at the button end of the fruit. At 10° to 25°, damp atmospheres of 95 to 98 per cent. relative humidity appeared to favour fungal invasion more than those of 70 to 80 per cent.

MARCHIONATTO (J. B.). **La gomosis o pie podrido del Naranjo (rectificationes fitopatologicas).** [Gummosis or foot rot of the Orange (phytopathological corrections).]—*Physis*, Buenos Aires, ix, 32, pp. 94–98, 1928.

The author here adduces evidence for the accuracy of his statement, called in question by Fawcett [*R.A.M.*, vi, p. 480], as to the

occurrence of the citrus gummosis due to *Phytophthora parasitica* in the Argentine.

BALLY (W.). **Eerste rapport over de topsterfte van de Koffie in de Residenties Benkoelen en Palembang.** [First report on the top die-back of Coffee in the Benkoelen and Palembang Residencies.]—*Arch. voor Koffiecult. Nederl.-Indië*, ii, 2, pp. 53–132, 17 pl., 1928. [English summary.]

A full description is given of the external and internal symptoms of the top die-back of coffee which has been observed since 1926 in the Benkoelen and Palembang Residencies of Sumatra [*R.A.M.*, viii, p. 100].

The disease is considered to bear little resemblance to the die-back reported from Uganda [ibid., v, p. 16] or in the Nilgiris in India. In both these cases the die-back symptoms are constantly associated with debility in the bushes, whereas in Sumatra there seems to be no correlation between the occurrence of die-back and cultural methods, soil or other external conditions, or weakness of the bushes.

Fungus hyphae were found in the tracheae of every infected bush examined, even when the disease was only in an incipient stage, while in more advanced cases the vessels are occluded by wound gum and tyloses. These hyphae are absent in normal bushes, and it is concluded that the top die-back is a tracheomycosis analogous to the *Verticillium* wilt of herbaceous and woody plants in Holland [ibid., vi, p. 135] and other countries. Some of the chief points of resemblance between the coffee die-back and the tracheomycosis of cherry trees are presented in parallel columns.

The following organisms were isolated from diseased material belonging to twenty different bushes: *Pestalozzia versicolor*; a *Gloeosporium* characterized by oval conidia, 15 to 20 by 4 to 5 μ, and considered to be probably identical with *Colletotrichum coffeanum* [*Glomerella cingulata*: ibid., vi, p. 57]; *Cladosporium herbarum*; *Verticillium lateritium* [ibid., v, p. 13]; and an undetermined species of *Diplodia*. In some of the cultures submitted to Prof. Westerdijk for examination *Fusarium moniliforme* [*Gibberella moniliformis*] also occurred. Inoculation experiments with these organisms on healthy adult trees are in progress, but the results of this work are not yet sufficiently advanced to warrant any definite conclusions as to their parasitism.

In the absence of exact statistical data it is difficult to estimate as yet the economic significance of the disease. Observations on young trees [which are tabulated] showed that the time elapsing between the first symptoms of infection and the die-back of the tops varies from one to four months or more. The fact that no hyphae were found in any of the roots examined suggests that infection probably occurs through stem wounds inflicted in topping and stumping operations, and the like. Investigations are being conducted to ascertain whether infection can be prevented by covering these wounds with a protective substance, such as tar. It is recommended that, in districts where top die-back is prevalent, coffee should be grown on the double stem system, since cases have been observed in which one stem has remained healthy while the

other died off. Only two cases of infection have hitherto been detected in *Coffea arabica*, though the latter sometimes grows in close proximity to the diseased *C. robusta* plantations, and it is suggested that the selection of resistant varieties may prove the best means of control.

A postscript is added stating that the top die-back of coffee has also been found in the Kloet district of Java and is considered by experienced planters and the scientific staff to be a disease not previously observed in that country.

TAUBENHAUS (J. J.) & DANA (B. F.). **The influence of moisture and temperature on Cotton root rot.**—*Texas Agric. Exper. Stat. Bull.* 386, 23 pp., 5 graphs, 1928.

The authors describe investigations in Texas from 1923 to 1927 to ascertain the influence of rainfall and atmospheric temperature and humidity upon the incidence of root rot of cotton (*Phymatotrichum omnivorum*) [*R.A.M.*, vii, p. 704] as shown by the wilting and death of the plants.

The data collected [which are tabulated, expressed graphically and fully discussed] show that the disease is favoured principally by heavy rainfall early in the growing season. In dry years the loss from the disease ranged from 9·8 to 30 per cent. of the crop, but in wet years sometimes amounted to over 50 per cent.

Each year infection increased until the growth of the plants slowed down owing to reduction in the available moisture; no close relation was observed between rainfall and this phase of the disease.

Infection was checked during the usual mid-season drought, but rose again with the renewal of heavy rain in September or early October.

No definite relation was established between atmospheric humidity and infection, but the high temperature (about 80° F.) prevailing annually between June and October favours severe infection, which, however, declines sharply with the sudden drop to about 50° F. that occurs early in November, in spite of abundant rain. This check comes, however, too late to be of economic importance.

STREETS (R. B.). **Studies of Texas root rot in Arizona.**—Abs. in *Phytopath.*, xviii, 11, pp. 952–953, 1928.

Texas root rot (*Phymatotrichum omnivorum*) [see preceding abstract] causes the greatest economic loss of any Arizona plant disease. In a two-year study of a life-history of the causal organism, all attempts at conidial germination were unsuccessful. The fungus advances through the soil by means of rhizomorphs composed of a large central hypha enveloped by a sheath of finer mycelium bearing the typical slender, cruciform-branched appendages. Primary infection on cotton and lucerne usually occurs on the taproot 6 to 12 inches below soil level, and is effected by a combined wedging action of the hyphae between the cortical cells, and by the penetration and filling of the adjacent cells with hyphae. Selections from very severely infested fields of Pima and Acala cotton have been grown for two years on heavily diseased

soil, and certain of the surviving progenies give promise of a fair degree of resistance. Soil sterilization with formaldehyde, organic mercury salts, carbon bisulphide, or sulphuric acid has proved effective to a limited extent.

MYERS (J. G.). **The incidence of a fungal parasite of scale-insects in New Zealand.**—*Bull. Entomol. Res.*, xix, 2, p. 181, 1928.

At York Bay, Wellington, and Kawakawa, North Auckland, New Zealand, the author observed *Aegerita webberi* [*R.A.M.*, vi, p. 93] parasitizing the scale-insect *Ctenochiton viridis*. In both localities the chief host plants of this insect are *Nothopanax arboreum* and *Hedycarya arborea*, but while every plant appeared to be heavily infested, the fungus was found only on the scales on *H. arborea*. In many instances every scale on the plant was attacked.

DA FONSECA (O.). **Algumas considerações de ordem geral sobre as dermatomycoses.** [Some considerations of a general nature on dermatomycoses.]—Reprinted from *Sciencia Med.*, vi, 11, 7 pp., 1928.

This is a discussion in general terms on the various environmental factors contributing to the development of dermatomycoses in man and animals. In connexion with the etiology of these diseases, the author emphasizes the necessity for caution in diagnosis. There is thought to be no doubt that many of the fungi described in recent publications as parasitic on man are secondary saprophytes. The isolation of such organisms from cutaneous lesions, the intestinal tract, or the respiratory organs is of no significance unless they can be definitely implicated as agents of infection.

PANAYOTATOU (Mme A.). **Sur la blastocystose. Trois cas d'entérite à Blastocystis hominis.** [On blastocystosis. Three cases of enteritis due to *Blastocystis hominis*.]—*Bull. Soc. Path. Exot.*, xxi, 9, pp. 755–760, 1928.

Clinical details are given of three cases of human enteritis caused by *Blastocystis hominis* [*R.A.M.*, v, p. 98] at Alexandria.

STOVALL (W. D.) & GREELEY (H. P.). **Bronchomycosis. Report of eighteen cases of primary infection in the lung.**—*Journ. Amer. Med. Assoc.*, xci, 18, pp. 1346–1351, 8 figs., 1928.

Full clinical details are given of 18 cases of bronchomycosis, in 12 of which fungi of the *Monilia* [? *Candida*] type were considered to be responsible for the condition and produced lesions on inoculation into animals. From the results of their investigations the writers infer that primary fungous infection of the lungs is much more common than is generally supposed [cf. *R.A.M.*, vii, p. 578]. Yeast-like fungi, in particular, appear to establish themselves in the lung tissue when resistance is lowered, and may become the predominating etiological factors in the progress of disease.

CATANEI (A.). **Étude des teignes dans le Sud Oranais (Algérie).** [Study of ringworms in south Oran (Algeria).]—*Bull. Soc. Path. Exot.*, xxi, 9, pp. 729–735, 1928.

Of the 694 white and native children examined in south Oran (Algeria), 212 (30·5 per cent.) were affected by ringworm of the scalp associated with *Trichophyton violaceum*, *T. glabrum*, and *Achorion schoenleini*. The incidence of infection was highest among the whites.

CLEVELAND (D. E. H.). **A case of linear sclerosis attributed to infection with Epidermophyton.**—*Brit. Journ. of Dermatology*, xl, 11, pp. 451–453, 1928.

The writer was consulted by a Canadian woman on account of numerous, ill-defined, pale pink, scaly lesions on the palm of the left hand. The condition had been intermittently present for twenty years, and some months before examination a similar eruption developed on the legs and arms. Scales from the left palm and scrapings from the interdigital spaces on the feet showed the presence of numerous hyphae resembling those of *Epidermophyton*. The patient's condition is attributed to long-standing infection probably by *E. inguinale* [*R.A.M.*, vii, p. 636].

DA FONSECA (O.) & LEÃO (A. E. DE A.). **Sobre os cogumelos da piedra brazileira.** [On the fungi of Brazilian 'piedra'.]—*Mem. Inst. Oswaldo Cruz, Supplemento* 4, pp. 124–127, 2 pl., 1928. [Portuguese, with English translation.]

In connexion with a brief discussion on the taxonomy and morphology of the causal organisms of Brazilian 'piedra', the authors state that they have examined 28 cases, all of which showed the characteristic black, hard nodules adhering to the hair and containing the cysts of Horta [*R.A.M.*, vii, p. 783], which are thought to be asci and which contain curved fusiform spores. They have recently isolated, from infected hair, both *Trichosporium hortai*, which forms dry, black colonies covered with aerial hyphae, and the so-called Colombian form, known as *T. giganteum* [ibid., vii, p. 783], which has dry or wet, whitish-yellow, cerebriform colonies. Cultures of both forms have been obtained from the same case, so that neither can be definitely identified as the causal agent of the piedra nodules. In two-months-old carrot cultures of *T. hortai*, the writers observed fusiform, greenish-yellow spores measuring 30 by 10 μ and furnished at each end with a very slender, hyaline appendage, 30 μ in length. These bodies agree with those occurring in the hair nodules of Brazilian piedra, and their presence is hereby provisionally made the basis of a new genus, *Piedrai*, with the type species *P. hortai*, unless this should prove to be identical with the earlier named *T. giganteum*.

DELAMARE (G.) & GATTI (C.). **Culture de la 'piédra' paraguayenne.** [Culture of the Paraguayan 'piedra'.]—*Comptes rendus Soc. de Biol.*, xcix, 31, pp. 1425–1427, 1928.

Details are given of cultures of *Trichosporium hortai*, the causal organism of 'piedra' in Paraguay [*R.A.M.*, vii, p. 782], on various

media. On glucose agar the hyphae are composed of brown or greenish rectangular cells, 6 by 4·5 μ (occasionally 9 by 3 μ). The cysts of Horta found in the nodules on the hairs from which the cultures originated [see preceding abstract] did not develop under artificial conditions.

NICAUD (P.). **Les formes actinomycosiques de l'Aspergillus fumigatus.** [The actinomycotic forms of *Aspergillus fumigatus.*]—*Comptes rendus Soc. de Biol.*, xcix, 33, pp. 1565–1567, 1928.

In the course of inoculation experiments on guinea-pigs and rabbits with *Aspergillus fumigatus,* the writer has frequently observed actinomycotic forms of the fungus (rosette- or star-shaped) in the renal lesions. These highly differentiated forms appear to be associated with some special environmental condition.

BÖHMIG (F.). **Richtige Anwendung des Uspulun.** [Correct use of uspulun.]—*Gartenwelt*, xxxii, 44, pp. 607–608, 1928.

Referring to recent complaints of the damage caused by uspulun in propagating beds [*R.A.M.*, viii, p. 107], the writer states that this is due to the incorrect use of the disinfectant. A 0·5 per cent. solution may be applied to the walls of frames, &c., but it is too strong for the soil of the seed-beds, especially where this consists of a thin layer of sand over peat mould. A considerable proportion of the solution is fixed by the peat mould and cannot afterwards be dispersed even by repeated watering. Injury to cuttings may be avoided by making the upper layer of sand sufficiently deep, so that the roots are formed in it. On no account should the concentration of the solution exceed 0·1 per cent.

PLUNKETT (O. A.). **The occurrence of Peronospora sparsa Berk. on hot-house Roses in southern California.**—Abs. in *Phytopath.*, xviii, 11, p. 950, 1928.

Peronospora sparsa [*R.A.M.*, vii, p. 325] caused spotting and defoliation of young rose leaves in greenhouses in southern California in 1927. The disease delays the time of blooming by two or three weeks. Poor ventilation, excessive humidity, high day and low night temperatures appear to be factors in the causation of the disease, which may be controlled by improving these conditions and spraying with 5–5–50 Bordeaux mixture.

PAPE [H.]. **Der gefährliche Chrysanthemumrost und seine Bekämpfung.** [The destructive Chrysanthemum rust and its control.]—*Gartenwelt*, xxxii, 45, pp. 623–624, 1 fig., 1928.

Heavy damage was caused in Germany during 1926 and 1927 by chrysanthemum rust (*Puccinia chrysanthemi*) [*R.A.M.*, vi, p. 164; vii, p. 722]. The affected leaves fall prematurely and the diseased plants are stunted and produce few flowers. The fungus survives from year to year through infection of the basal shoots arising from the mother plant, by spores from the diseased leaves of old stems. The spores are also believed to remain viable

through winter on the woodwork and glass of frames and greenhouses, on fallen chrysanthemum leaves, and in the soil.

Among other varieties showing comparative resistance to *P. chrysanthemi* may be mentioned Ami Bergeret, Mrs. George Monro Jr., Majestic, Queen Mary, and Sterling Stand, while Brooks, Captain Julian, Daily Mail, Rheinland, and others are highly susceptible. The Marguerite Desjouis, Etzolds Goldiana, Lionet, and Alice M. Love are reported to be immune from rust. The control of the disease should be based on suitable cultural measures, including the selection of resistant varieties, supplemented by spraying with a standard fungicide, e.g., Bordeaux mixture or erysit, or dusting with finely ground sulphur.

SUNDARARAMAN (S.) & RAMAKRISHNAN (T. S.). **Foot-rot and wilt of Antirrhinums.**—*Mem. Dept. Agric. India*, Bot. Ser., xvi, 3, pp. 83–100, 7 pl. (2 col.), 2 graphs, 1928.

Snapdragons (*Antirrhinum majus*) at Ootacamund, Coonoor, and Coimbatore [Madras] are affected by a wilt and collar rot associated with a species of *Phytophthora*. The leaves of diseased plants droop and wither, the bark of the rotted collar is readily detachable; and the roots are often affected by a rot of the cortex. The wood of the collar region is water soaked and shows a brown or black discoloration. The hyphae and oospores of the causal organism are present in the tissues (including the vessels) of the diseased portions, and a few sporangia on the surface.

The morphological and cultural characters of the fungus, which was grown in pure culture, are fully described. Sporangia were seldom observed in culture on solid media or on the affected plants, but they developed profusely in water. They are terminal, ovate, piriform, or globose, distinctly papillate, and measure 18 to 66·8 by 12 to 42·8 μ (average 41 by 30 μ). They germinate either by means of germ-tubes at the papillary end (the usual method in culture media) or by the liberation of 2 to 16 zoospores, 9 to 12 μ in diameter. The thick-walled (3 to 3·75 μ), spherical, yellowish to reddish-brown oospores measure 18 to 30·6 μ (average 26·2 μ), and the oogonia are 21·6 to 36 μ in diameter (average 30·87 μ). Both paragynous and amphigynous antheridia were observed, the former predominating on solid media and being usually borne on a separate hypha from that on which the oogonium is developed.

This species of *Phytophthora* closely resembles *P. pini* [*R.A.M.*, v, p. 57] in various particulars. It is distinguished, however, by its larger oogonia (29 μ in *P. pini*); by the single antheridium (2 to 4 may occur in *P. pini*); and by the complete absence of intercalary sporangia. It is, therefore, considered to be a variety of *P. pini* and is named *P. pini* var. *antirrhini* n. var., an English diagnosis being given.

The fungus perennates by means of the oospores on fragments of infected roots or bark left in the soil. The disease developed on plants grown in pots containing infected soil, and was also readily induced in healthy snapdragon plants by inoculation with pure cultures of the fungus. Inoculation experiments on a number of other hosts of various species of *Phytophthora* gave negative results.

COOPER (D. C.) & PORTER (C. L.). **Phytophthora blight of Peony.**—*Phytopath.*, xviii, 11, pp. 881–899, 1 pl., 4 figs., 1 diag., 1928.

The *Phytophthora* blight of peony, which has been reported from several places in the United States [*R.A.M.*, i, p. 35], is characterized by the production of dark brown to black, somewhat leathery lesions on the stems, leaves, and buds, while under field conditions a destructive crown rot may occur.

In 1927, the causal organism was isolated from blighted stalks of two varieties in Indiana. Inoculation experiments [details of which are given] on healthy peony seedlings gave positive results, the fungus being reisolated from the diseased tissues. Inoculation tests were made on a number of other plants [which are listed], but infection developed only in wounded tomatoes and apples.

Inoculation experiments on peonies with a number of other species of *Phytophthora* gave negative results. The species is considered to be distinct from the allied *P. fagi* and *P. cactorum* [ibid., ii, p. 135], and is named *P. peoniae* n. sp. with a diagnosis in English. It is characterized by intercellular hyphae 7 to 10 μ in diameter, producing small, sub-spherical haustoria; conidiophores indistinguishable from the mycelium, bearing on short, simple, lateral branches 1 to 15 ovate, papillate conidia measuring 26·2 to 41·2 by 22·5 to 35·6 μ (mostly 31 to 33 by 26 to 28 μ), germinating by germ-tubes or by zoospores measuring 10 to 12 by 8 to 10 μ; a few chlamydospores are formed (only on sterilized peony stems), 30 to 40 μ in diameter. The oogonia are pale brownish, 26 to 34 μ in diameter, borne on long stalks, with oval to globose paragynous antheridia closely appressed to the base at the side of the oogonial stalk and frequently twisting round the latter; they contain globose, thick-walled oospores measuring 24 to 30 μ in diameter.

The optimum temperature for the growth of *P. peoniae* is between 20° and 26° C., the minimum and maximum 14° and 34°, respectively. Development was better at P_H 8·4 than at P_H 5·2. Spore production ceased under red and yellow-orange lights. Growth was not inhibited by staling, and no check to the development of the organism occurred when two colonies were grown on opposite sides of a Petri dish. A distinct antagonism was observed, however, between *P. peoniae* and *P. erythroseptica*.

PETHYBRIDGE (G. H.). **A new disease of the Dahlia.**—*Gard. Chron.*, lxxxiv, 2186, pp. 393–394, 1 fig., 1928.

A brief, popular account is given of the symptoms and life-history of *Entyloma dahliae*, the causal organism of a leaf disease of dahlias that has been reported in recent years from various European countries [*R.A.M.*, vi, p. 360], and the presence of which was first recorded in England during 1927. The disease appears chiefly to affect the so-called cactus varieties, the pompons being more resistant and the varieties derived from *Dahlia merckii* apparently immune. In 1928 specimens of infected dahlias were submitted for inspection from Glamorganshire and the vicinity of Reading, and it is considered probable that the disease also occurs in other localities. Control measures should be based on thorough sanitation, including the destruction of all diseased material, and may possibly be supplemented by spraying with a standard fungicide

FERRARIS (T.). **Il marciume giallo dei Giacinti.** [Yellow rot of Hyacinths.]—*Curiamo le Piante!*, vii, 11, pp. 209–212, 1 fig., 1928.

A brief, popular account is given of yellow rot of hyacinths (*Bacterium* [*Bacillus*] *hyacinthi*) [*R.A.M.*, vi, p. 164], for the control of which the following recommendations are made. Affected bulbs in any lot should be destroyed and the remainder, after removal of the dry, outer scales, should be steeped in a 10 to 15 per cent. solution of iron sulphate, and should be left to dry in the air before planting. Light applications of mineral fertilizers are advised, and if the soil is heavy it should be mixed with sand. Hyacinths should not be grown where infection was severe in the previous year. If the plants appear to be affected they must be removed and iron sulphate crystals or quicklime placed in the holes.

ABE (T.). **Studies on a new disease of Celosia cristata caused by Fusarium celosiae n. sp.**—*Mem. Coll. Agric., Kyoto Imper. Univ.*, 7, pp. 51–64, 2 pl., 1928.

Celosia cristata, which is stated to be widely grown as an ornamental plant in Japan, has recently been attacked near Kyoto by a species of *Fusarium*.

Two chief phases of the disease may be distinguished, viz., the damping-off of seedlings and the leaf blight of mature plants. The former is accompanied by the development of blackish-brown, water-soaked lesions; in the later form the upper sides of the leaves show rusty or violet-carmine (later chestnut-brown) blotches, with concentric zones of reddish-brown. The lower surfaces assume a reticulate aspect, and in some cases cinnamon-coloured, rusty spots are formed on the stems and petioles. The diseased stems are cracked in places and present a somewhat cankered appearance. The upper parts of the inflorescences are also subject to infection.

Celosia seedlings inoculated with pure cultures of the *Fusarium* developed the typical symptoms of the disease, and positive results were also given by inoculation experiments on the stems and leaves of older plants.

The causal organism is regarded as a new species of *Fusarium* and is named *F. celosiae*, with a Latin diagnosis. The conidia, which are produced in pionnotes or sporodochia, are hyaline (salmon coloured in the mass), falcate, pedicellate or subpedicellate, slightly truncate at the apex, and measure 17·5 to 62·5 by 3·25 to 6·25 μ (average 47·5 by 4·25 μ); they are usually slightly constricted at the septa, which number 0 to 6 (average 4). Brown, thick-walled, spherical or irregular chlamydospores, measuring 5·63 to 9·39 μ (average 7·5 μ) are occasionally formed intercalarly in the hyphae as well as in the conidia. The globose sclerotia, measuring 185 to 1,110 μ in diameter, are bluish-brown externally and hyaline within.

The fungus made good growth on potato and apricot decoction agar, cornmeal agar, and other media, the optimum temperature for development being 28° to 32° C., with a minimum at 8° to 10°.

The organism remained viable even after an hour's immersion in water heated to 58°, but was destroyed by 20 minutes' soaking at 62°.

FERDINANDSEN (C.) & WINGE (Ø.). **Parasitisk Optræden af Epochnium monilioides Lk. paa Nellikerod.** [Parasitic occurrence of *Epochnium monilioides* Lk on Geum.]—*Dansk. Bot. Arkiv.*, v, 17, 5 pp., 2 figs., 1928. [English summary.]

The authors describe briefly the occurrence of *Epochnium monilioides* Lk on *Geum intermedium* and *G. urbanum* near Lyngby, Denmark. The fungus attacked the plants at the base and extended upwards, forming, chiefly in the stamens, chains of bicellular, brown conidia averaging 7 to 12 by 4 to 6 μ (occasionally up to 20 by 2 μ and with three or four cells).

The fungus persisted year after year in the infected plants and caused partial or total sterility. *G. rivale* remained healthy in the midst of the diseased *G. urbanum* and *G. intermedium* plants on the experimental plots at Lyngby.

Pure cultures were obtained on synthetic malt and oatmeal agar, as well as on rice. A marked tendency towards coremial formation was observed on oatmeal agar. Possibly this phenomenon, together with the formation of elongated conidial chains resembling hyphae, explains the position assigned to *E. monilioides* among the Macronemeae. The writers' investigations, however, suggest that it would be better placed in the Micronemeae.

The apical inoculation of young basal shoots of *G. urbanum* caused sterility and some degree of stunting.

YOUNG (P. A.) & MORRIS (H. E.). **Sclerotinia wilt of Sunflowers.**—*Montana Agric. Exper. Stat. Bull.* 208, 32 pp., 3 pl., 8 figs., (1 on cover), 1927. [Received February, 1929.]

Sunflower [*Helianthus annuus*] wilt caused by *Sclerotinia libertiana* [*S. sclerotiorum*: *R.A.M.*, vii, p. 785] was first reported in Montana in 1920, where the disease has been found to kill from 0·1 to 80 per cent. of the plants in commercial fields when rotation is not practised. The mycelium rapidly decomposes parenchymatous tissues, but apparently does not attack lignified tissues, which often separate out, giving the cankers a shredded appearance. Sclerotia occur in the pith cavities of the roots and flower heads, and are also found in and on the seed. In 1927, at least 1,000 apothecia of *S. sclerotiorum* were produced in one field by sclerotia left in the soil from the preceding crop. The fungus enters the host through wounds caused by mechanical agencies or the development of branch roots, and spreads very rapidly along the rows unless the stalks are at least 30 cm. apart. Birds appear to carry the mycelium from diseased heads and the soil to wounds which they scratch in healthy heads. Greenhouse and field inoculations [details of which are given] with pure cultures from the ascospores of *S. sclerotiorum* gave positive results.

For control the author recommends crop rotation, plant sanitation, and the use of clean seed, much of that used in the past being imported from Russia, where the disease is prevalent [loc. cit.].

WEIMER (J. L.). **A wilt disease of Alfalfa caused by Fusarium oxysporum var. medicaginis, n. var.**—*Journ. Agric. Res.*, xxxvii, 7, pp. 419–433, 2 pl., 3 figs., 1928.

The wilt disease of lucerne recently described by the author from the State of Mississippi [*R.A.M.*, vi, p. 669] was found to be caused by a distinct strain of *Fusarium oxysporum*, which is named var. *medicaginis*, and of which a detailed morphological and cultural description is given. It differs from the type species chiefly in its parasitism and in the size of its spores, which average 40 by 4·4 μ, with a range of 25 to 50 by 4 to 5·5 μ. It also appears to have a much more limited geographical distribution than *F. oxysporum*, since it is known to occur only in Mississippi and possibly California. This limited distribution renders the disease of no great economic importance at the present time, though in some diseased fields 15 per cent. of the plants were affected. No soil or climatic factors are known that could prevent its spread to other regions.

The disease is present in about the same amount throughout the growing season. The fungus is believed to be spread from one plant to another largely by soil water. It apparently gains entry into the host either through wounds or directly through the epidermis, especially of small rootlets. After reaching the main roots the fungus makes more rapid progress upwards, and when the main tap root becomes infected, symptoms of the wilting may appear in the aerial parts in about a month, though sometimes they take much longer to develop. In the final stage the fungus darkens the entire woody cylinder of the roots of small plants, eventually causing their decay.

Although no control experiments were made, observations on fertilizer plots indicated that lime or superphosphate (acid phosphate) had no effect on the incidence of the disease. Practically all the varieties of lucerne tested were susceptible, although in many instances very few diseased plants were seen. Kansas common, Grimm, and Hairy Peruvian varieties all appeared to be about equally susceptible. Judging by what is known of other related species of *Fusarium*, it is believed that a rather long rotation will be necessary to rid infected fields of the wilt.

SCHWARTZ (E. J.) & COOK (W. R. I.). **The life-history and cytology of a new species of Olpidium; Olpidium radicale sp. nov.**—*Trans. Brit. Mycol. Soc.*, xiii, 3–4, pp. 205–221, 3 pl., 1928.

A detailed description is given of the life-history and cytology of a new species of *Olpidium*—*O. radicale*—which was found parasitizing the roots of *Veronica beccabunga* in a few low-lying meadows near Dunton Green, Kent. No other host of the fungus was observed in nature, but under laboratory conditions it appeared to be capable of attacking the roots of certain grasses, such as *Poa annua*, and also of seedlings of *Lepidium sativum*. *O. radicale* [a Latin diagnosis of which is given] is considered to be a link in the evolutionary series from the simple condition in *O. brassicae* to the more complex state found in species of the genus *Olpidiopsis*.

KIDD (MRS. M. N.) & TOMKINS (R. G.). **Fungal diseases of imported fruits.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1927*, pp. 45–48, 1928.

A table is given listing the fungi found at Covent Garden market on grapefruit, oranges, apples, pineapples, grapes, and other fruit imported from various countries. The type of wastage caused in each case is indicated.

TOMKINS (R. G.). **The water relationships of fruit-rotting fungi,**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1927*, pp. 36–38, 2 graphs, 1928.

Spore germination studies, carried out over a range of temperatures and humidities with spores of *Alternaria citri*, *Colletotrichum gloeosporioides*, *Cephalothecium* [*Trichothecium*] *roseum*, and *Fusarium fructigenum*, showed that all these fungi could germinate in saturated and subsaturated atmospheres with no other source of water, that at any given temperature the time elapsing before the appearance of the germ-tubes increased as humidity decreased, and that the nearer the temperature to the optimum the lower the humidity at which germination was possible; germination was observed in a relative humidity of 91 per cent., but not in one of 87 per cent. The curve showing the relation between the time required for germination and the relative humidity moved towards the zero of the time axis as the temperature approached the optimum, but away as the latter passed beyond this point.

PAPE (H.). **Die Fäulnis des frischen Obstes auf dem Winterlager und ihre Verhütung.** [The decay of fresh fruit in winter storage and its prevention.]—*Mitt. Gesellsch. Vorratsschutz*, iv, 6, pp. 71–74, 1928; v, 1, pp. 10–13, 1929.

A description is given in popular terms of the symptoms of decay in stored fruit and mode of infection of some well-known fungi responsible for it. Directions are also given for the prevention of storage rots by careful picking and handling, and by the provision of suitable storage conditions.

BARKER (J.). **Wastage in fruit commerce.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1927*, pp. 38–42, 1928.

A survey of the character and extent of wastage in imported fruit [cf. *R.A.M.*, viii, p. 50] made at Covent Garden market showed that in addition to the losses experienced in South African plums owing to so-called 'over-ripeness', much deterioration was caused, especially in Wickson plums, by physiological breakdown attributed to cold storage; in some consignments of this variety the condition rendered the fruit inedible, though in others it only impaired the quality. Physiological breakdown was also observed in a number of varieties of peaches from South Africa. The flesh was discoloured, generally 'mealy' or 'woolly', and the skin over the affected part was easily broken by lateral pressure—a condition known as 'slip-skin'.

Green mould (*Penicillium digitatum*), the chief cause of wastage in citrus fruits, caused serious losses in oranges from Spain,

Palestine, Brazil, and the Argentine; blue mould (*P. italicum*) was rarely observed on arrival, but frequently appeared on fruit after it had been kept for observation. Stem-end rots due to *Diplodia* [*natalensis*] (the second most serious type of wastage in citrus fruits) caused severe losses in oranges and grapefruit from Jamaica, the Isle of Pines, and British Honduras. A species of *Phomopsis* caused fairly extensive damage to oranges from the Argentine and Brazil, and occasional losses in oranges and grapefruit from Florida and Porto Rico. Loss was caused in South African oranges and grapefruit by *Alternaria citri*, chiefly as stem-end and centre rot; in one shipment *Colletotrichum gloeosporioides* was present.

The heaviest losses occurred in oranges from Spain and Palestine, where little attention is given to picking and handling, by which other countries have largely reduced rotting caused by *Penicillium*. The reduction observed in the losses due to *Diplodia* is rather to be attributed to improved orchard conditions and to spraying before picking.

SIEGLER (E. A.). **Studies on the etiology of Apple crown gall.**—*Journ. Agric. Res.*, xxxvii, 5, pp. 301–313, 6 pl., 1928.

After a brief review of recent work on the etiology of crown gall of apple [most of which has been noted in this *Review*], the author states that his isolations from the malformations on root-grafted apple trees known as woolly knot crown gall [*R.A.M.*, vii, p. 145; viii, p. 159] almost invariably yielded an organism that appeared to be identical in its cultural characters and reaction on the Paris daisy [*Chrysanthemum frutescens*] with *Bacterium tumefaciens* as described by E. F. Smith and his co-workers. It produced definite and pronounced galls or malformations on Paris daisy, apple shoots, sugar beet, and *Bryophyllum calycinum*, but failed to do so on tomato and tobacco, although very slight disturbances occasionally occurred in the tissues of the latter hosts at the point of inoculation. When inoculated on apple seedlings of the Chenango variety, the organism consistently produced a malformation consisting of a protruding mass of root primordia, morphologically identical with what is considered as typical aerial gall, from which it was subsequently reisolated.

While emphasizing the desirability of growing apple grafts in sterile soil before passing full judgement on the question of the etiology of similar malformations, the author considers that the facts reported in this paper support the hypothesis that the strain of *Bact. tumefaciens* which is so consistently obtained from the woolly knot crown gall and which, following the usage of Smith, he calls the apple strain, can cause certain types of malformations or galls on root-grafted apple trees.

NIXON (E. L.). **The migration of Bacillus amylovorus in Apple tissue and its effects on the host cells.**—*Pennsylvania Agric. Exper. Stat. Bull.* 212, 16 pp., 1 double pl., 1927. [Received February, 1929.]

After a review of the literature dealing with the relations of *Bacillus amylovorus* to the tissues of the host, the author describes

his studies of artificially infected apple water sprouts and of the dormant cankers that subsequently formed at the bases of these sprouts [*R.A.M.*, viii, p. 177]. The inoculations were made by needle pricks, and at subsequent intervals blocks were removed at the points of inoculation for examination.

About an hour after inoculation the first signs of zoogloeal formation can be observed along the margins of the wound in the cortical region. The zoogloeae penetrate into the intercellular spaces of the inner cortex, extending radially for only a short way but rapidly progressing tangentially around and up and down the shoot. The region of optimum development is situated about 10 layers of cells in from the epidermis. Under very favourable conditions extension may also occur from the margins of the puncture in the vascular region and in the pith, but in these regions is always slow. Later on, as the inner cortical spaces become gorged with bacteria, the invasion of neighbouring tissues may follow, and the movement of the bacteria outwards through the cortex may progress until masses break through the epidermis and ooze to the surface in droplets. The last tissues to be invaded from the cortex are the cambium, xylem, and pith, and this invasion seems to result from pressure of large masses of bacteria, rather than by free progress along the spaces.

In the early stages the host cells are not appreciably affected, the pseudopodial tips of the zoogloeae extending freely along the intercellular spaces. After some 48 hours, however, the surrounded cells appear as if plasmolysed, and the cell walls finally yield to pressure so that schizogenous cavities develop. Still later, coinciding with a shortening of the rods of the organism, the bacteria are found within the cells, the wall and contents of which are destroyed. This occurs chiefly in the older tissues of the shoot and results in the formation of lysigenous cavities of various size. In certain cells of these older regions the bacteria appear to accumulate in closely packed masses, surrounded by a dense gelatinous layer, the whole forming a cyst-like body.

The examination of the dormant cankers revealed no free bacteria, but in apparently living cells similar dense masses of the organism to those just described, surrounded by the gelatinous matrix, were observed. When these are broken up in water they liberate bacilli resembling those found in the earlier zoogloeal stage.

These 'cysts' are believed by the author to represent a dormant stage of *B. amylovorus* from which, when water is imbibed in the spring, the active form of the organism is released.

JEHLE (R. A.) & HUNTER (H. A.). **Observations on the discharge of ascospores of Venturia inaequalis in Maryland.**—*Phytopath.*, xviii, 11, pp. 943–945, 1928.

For four years the writers have made a study of the time of the first ascospore discharge of the apple scab fungus (*Venturia inaequalis*) in Maryland [cf. *R.A.M.*, viii, p. 45]. In 1925 fallen apple leaves with scab lesions were collected on 2nd March, one lot being placed in a greenhouse at 60° F. and another in an insectary at 45°. On 27th March the first ascospores were discharged in the

greenhouse and the next day in the insectary. Evidently, therefore, the ascospores developed equally at both temperatures.

In 1926 two lots of diseased leaves were left in each of five orchards, one being kept under natural conditions and the other sprinkled daily with tap water. The earliest date of ascospore discharge was 12th April on the moistened leaves and 18th April on the others, while the latest dates were 28th April and 16th May, respectively. Rain fell between the dates of collection and the first ascospore discharge, but the number of showers did not equal the sprinkling applications. In every case rain fell on the day the ascospores were liberated from the unwatered leaves. It would appear, therefore, that up to a certain point the early maturation of ascospores is correlated with frequent applications of moisture.

In 1927 scarcely any of the fallen leaves showed scab lesions, but perithecia resembling those of *V. inaequalis* were found on nearly all and were as prevalent on the foliage in sprayed orchards as they were in those receiving no treatment. Similarly in 1928 the perithecia of the fungus were found thickly scattered over the entire surface of some of the leaves showing no visible lesions. In 1927 the first ascospore discharge in various parts of Maryland occurred at widely different stages in the development of the trees, ranging from the 'pre-pink' in the south-east to the 'calyx' in the extreme west. In 1928 the first discharge in the south-east occurred while the trees were still dormant.

Horne (A. S.). **Biological work: changes in the parasitic power of fungi attacking the Apple.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1927*, pp. 116–118, 1928.

In 1927, when reisolating the causal organism from the decayed tissues of apples inoculated with *Cytosporina ludibunda* [*R.A.M.*, iv, p. 227; v, p. 308], it was observed that some of the cultures differed in appearance and sporulation from the culture used for the inoculations. After repeatedly sub-culturing the reisolated fungi numerous strains were obtained which differed from the original parent culture in specific and even generic characters; resemblances to *Phomopsis*, *Phoma*, and *Diaporthe* were noted, and there were also several infertile strains with white, pink, or black mycelium. Bramley's Seedling and Worcester Pearmain apples were then inoculated with certain of these strains, and the results [which are tabulated] showed that except for strain C (*Phoma* type), which produced no decay, all the strains were more active than the original strain H, strains B (*Phomopsis* type), D (*Diaporthe*, derived from a single ascospore), and E (infertile white) being extremely virulent.

Carne (W. M.). **Bitter pit in Apples: some recent investigations.**—*Journ. Australia Council Sci. & Indus. Res.*, i, 6, pp. 358–365, 1928.

Further investigations conducted in Western Australia during 1928 into bitter pit of apples [*R.A.M.*, vii, p. 102] showed that this disease develops principally if not entirely after picking; the varieties most affected are Cox's Orange Pippin, Ribston Pippin, Cleopatra, Sturmer Pippin, Dunn's, and Granny Smith. The

disease previously confused with bitter pit, which develops on apples while they are still on the tree, is in reality the same as that termed 'cork' in America, and occurs in Australia chiefly in the form known as 'blotchy cork'; it is distinguished from bitter pit by the depressed spots, which are much larger, and more irregular than in true bitter pit, and are usually surrounded by a green halo. Blotchy cork was most prevalent on Cleopatra, Spitzenberg, Five Crown, Sturmer Pippin, Newtown Pippin, and French Crab apples.

In Jonathan spot [ibid., iv, p. 676], a condition that has also at times been confused with bitter pit, the spots may be larger than in the latter disease but do not penetrate the flesh. This condition was noted chiefly on Jonathan and Spitzenberg apples, but many other varieties, including Yates, were also affected.

To reduce bitter pit, apples destined for export should be picked later in the season than has been usual, and over-sized fruit should be avoided.

Directions are given for ascertaining the correct picking date for susceptible varieties by placing cut halves of apples in a solution of iodine for one half minute, when if the fruit is ready for picking, small scattered bluish spots (due to the action of iodine on the starch) will appear through the pulp, but not within the core line. If no colour develops the apples are over-mature, while those that are not yet ripe become coloured in large patches or throughout the pulp. The apples should be placed in cold storage shortly after picking.

KAVEN (G.). **Die Stippe der Äpfel.** [Bitter pit of Apples.]—*Die Kranke Pflanze*, v, 11, p. 187, 1928.

Bitter pit of apples [the symptoms of which are briefly described in popular terms: see preceding abstract] is stated to be most prevalent among varieties with large fruit of loose texture. The disease appears to occur principally during dry seasons on fruit from trees growing in loose soils, though some observers maintain that the condition is favoured by extreme humidity and heavy applications of nitrogen.

KIDD (F.) & WEST (C.). **Two types of storage internal breakdown in Apples.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1927*, pp. 42–43, 1928.

As a result of contact with investigators overseas the authors have reached the definite conclusion that there are two distinct types of internal breakdown in apples, as claimed by other observers [cf. *R.A.M.*, vi, p. 623; vii, p. 790], which occur under commercial conditions.

One type, 'low temperature internal breakdown' is due to the fruit being stored at temperatures below the limit of tolerance, and results in death before senescence has advanced to the normal extent. Internal conditions leading to the disease may be present before browning or collapse of the flesh occurs, and once established, removal of the fruit to higher temperatures accelerates their appearance. This type of breakdown seldom appears until after six to ten weeks' storage.

The second type, 'inherent internal breakdown' is more prevalent and appears more rapidly at high than at low temperatures. It causes heavy losses in British Columbian apples, especially Jonathans, and has been called Jonathan breakdown [ibid., iv, p. 550; v, p. 537], though as the disease occurs on other varieties the general name given above is preferred. The apples seem to be predisposed or otherwise to the condition at the time of gathering, and the disease may be avoided by picking before the critical stage of maturity is passed. This type of internal breakdown may occur even on trees in the orchard and often appears shortly after gathering, especially if the fruit is not placed in cold storage.

WORMALD (H.). **Further studies of the brown-rot fungi. III. Nomenclature of the American brown-rot fungi: a review of literature and critical remarks.**—*Trans. Brit. Mycol. Soc.*, xiii, 3–4, pp. 194–204, 1928.

Continuing his studies of the brown rot fungi [*R.A.M.*, vi, p. 619] the author subjects to a critical review the recent literature on the nomenclature of the American brown rot fungus which has been named *Sclerotinia americana* by Norton and Ezekiel [ibid., iv, p. 508]. The chief objection against accepting for it the name *S. fructicola*, as suggested by Roberts and Dunegan [ibid., vii, p. 32], is that there is no conclusive evidence to show that Winter's descriptions referred to a fungus with a conidial stage corresponding to the common American brown rot fungus, and that they do not differentiate between *S. americana* and *S. cinerea*, both of which occur in North America. These two species undoubtedly closely resemble one another in the morphology of their apothecia, and it has not yet been shown that they can be distinguished by an examination of these only. To illustrate this point, the table on which Roberts and Dunegan base their identification of *S. fructicola* with the common American brown rot fungus is reproduced together with figures taken from a table by the author showing the dimensions of asci and ascospores of *S. cinerea*. As they stand, the figures do not indicate that *S. fructicola* is morphologically more nearly related to the common American brown rot fungus than it is to *S. cinerea*. In the present state of knowledge and until further investigation allows of determining whether Winter's specific name can be retained as a valid one for the common American brown rot fungus, the author considers that the use of the name *S. americana* is preferable to distinguish this fungus from *S. cinerea*.

WORMALD (H.). **The present distribution of the brown rot fungi: its economic significance.**—*Journ. Min. Agric.*, xxxv, 8, pp. 741–750, 4 figs., 1928.

The author states that an examination of brown rot fungi (*Sclerotinia* spp.) [see preceding abstract] received from numerous regions over a period of ten years indicates that *S. fructigena*, the chief fruit-rotting fungus of Europe [*R.A.M.*, vii, p. 178], has not hitherto been found in Australia, New Zealand, or North America, but was received from Japan and Manchuria. *S. cinerea* forma *pruni* is found in the Pacific coastal regions of North America

(and was received by the author from California and Vancouver Island), but not in Australia or New Zealand. *S. cinerea* forma *mali* is apparently confined to Europe. *S. americana*, which occurs in North America, Australia, and New Zealand, is not at present found on fruit trees in England, but was observed on market consignments of peaches from Georgia and Ontario. The possibility and probable consequences of any one of these fungi being introduced into a region where it is at present unknown are discussed.

HEYDEMANN (F.). **Zur Bekämpfung der Moniliakrankheit an Sauerkirschen.** [On the control of the *Monilia* disease of sour Cherries.]—*Obst- und Gemüsebau*, lxxiv, 11, pp. 170–171, 1928.

Excellent control of the *Monilia* disease [*Sclerotinia cinerea*] on sour Morello cherries [*Prunus cerasus*: *R.A.M.*, vi, p. 105; vii, p. 648], which is stated to be spreading widely in north-west Germany, has been obtained by cutting back all the one-year-old shoots to a quarter or a third of their length. Presumably the fungus hibernates in the terminal buds or bud scales of these young shoots.

Sprøjtning af Stikkelsbærbuske samt Ribs- og Solbærbuske. [Spraying of Gooseberry and red, white, and black Currant bushes.]—*Statens Forsøgsvirksomhed i Plantekult. Meddel.* 146, 4 pp., 3 figs., 1928.

Brief, popular notes are given on the symptoms and control of *Gloeosporium ribis* and *Septoria ribis* on gooseberries and currants, and of *Puccinia pringsheimiana* [*R.A.M.*, v, p. 749] and *Sphaerotheca mors-uvae* (mainly on gooseberries, more rarely on currants) in Denmark. The first three fungi may be controlled by two applications of 1 per cent. Bordeaux mixture, one shortly after the bushes come into leaf and the second two to three weeks later. Attacks of mildew should be combated primarily by cultural measures [which are outlined], supplemented by a dormant spray of lime-sulphur 1 in 9, 4 per cent. copper sulphate, or formalin 1 in 40, and by two or three summer applications, at fortnightly intervals, of formalin 1 in 200 or lime-sulphur 1 in 30. Lists are given showing the differing degrees of susceptibility to scorching by lime-sulphur in some well-known commercial varieties.

GLEISBERG (W.). **Neuorientierung in der praktischen Bekämpfung des amerikanischen Stachelbeermehltaus.** [New developments in the practical control of American Gooseberry mildew.] —*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, viii, 12, pp. 111–113, 1928.

Discussing the prevalence of American gooseberry mildew (*Sphaerotheca mors-uvae*) in Europe, the writer states that the German Nurserymen's Association now attaches great importance to thorough pruning of the shoot tips, on which the fungus may persist during the winter without showing visible signs of infection; this process must of course be followed by the removal of all other diseased material and supplemented by a dormant applica-

tion of 0·8 per cent. formaldehyde. Bordeaux mixture (1 per cent.) is reported (*Gartenbauwissensch.*, ii, 1, 1928) to be preferable to sulphur preparations for the summer spray, since the latter cause very serious defoliation [but see *R.A.M.*, vii, p. 648].

GLEISBERG (W.). **Ein wichtiger Schritt zur Bekämpfung des amerikanischen Stachelbeermeltaues.** [An important step in the control of American Gooseberry mildew.]—*Obst- und Gemüsebau*, lxxiv, 12, pp. 177–179, 3 figs., 1928.

Directions are given in popular terms for the control of American gooseberry mildew [*Sphaerotheca mors-uvae*], with special reference to the pruning of the shoot tips at the close of the vegetative period [see preceding abstract].

HALL (J. W.). **American gooseberry mildew.**—*Gard. Chron.*, lxxxiv, 2190, p. 474, 1928.

Details are given of recent experiments carried out in Scotland in the control of American gooseberry mildew [*Sphaerotheca mors-uvae*] by two spray mixtures, viz., (1) 1 lb. copper sulphate, 2 lb. washing soda, and ½ lb. soft soap per 10 galls. of water; and (2) 1 lb. washing soda and 2 oz. soft soap per 4 galls. of water. No. 1 proved to be of little or no value as a protective. No. 2, applied on 25th May and 21st June to 53 bushes of different well-known varieties, e.g., Whitesmith, Langley Green, White Lion, and Crown Bob, gave much better results, the crop being practically clean except in the case of the Langley Green variety, which showed heavy infection.

GLEISBERG (W.). **Wurzelkropf an Himbeeren.** [Crown gall of Raspberries.]—*Obst- und Gemüsebau*, lxxiv, 11, pp. 163–164, 1 fig., 1928.

Recent German investigations have shown that crown gall of raspberries [*Bacterium tumefaciens*] causes comparatively little damage to the root system of the bushes. The disease may be readily controlled by the immersion of the suckers in a 0·5 to 1 per cent. uspulun-loam emulsion, as previously recommended for crown gall of fruit trees [*R.A.M.*, v, p. 494]. The suckers of young raspberry canes planted in 1927 between two rows of infected wild pear seedlings remained healthy in 1928.

SIMMONDS (J. H.). **Diseases of the Banana in Queensland.**—*Queensland Agric. Journ.*, xxx, 5, pp. 438–454, 6 pl., 1928.

In this paper notes are given on the symptoms, causes, and control of various banana diseases observed in Queensland.

Leaf spot (*Cercospora*) [*musae*: *R.A.M.*, vii, p. 225] prevails throughout practically all the banana-growing districts from northern New South Wales to Cairns. The characteristic symptom on the leaf is the appearance of light brown, then grey, linear or elliptical areas which become bordered with black and surrounded with a yellow halo. In severe infection the spotting passes from the lower leaves upwards, until all the leaves are killed and hang drooped round the rotting pseudostem. If severe defoliation takes place before the fruits have filled out, the bunch often remains

unmarketable. The disease is less severe on the Sugar and Lady's Finger varieties than on the Cavendish, possibly owing to the more open growth of the two former. Infection, which is purely seasonal, usually begins early in March, after which it becomes increasingly prevalent until it rapidly disappears in spring (about October). Preliminary experiments indicate that the vegetative growth and spore development of the fungus were retarded by temperatures above 80° F. Abnormally heavy rains in January and February appear to accelerate infection, while the lowered vitality of the plants induced by cool weather is also a contributing factor; severe individual infection is often associated with borer attack. The control measures provisionally suggested consist in the choice of a favourable site for planting; good cultivation and manuring; planting the suckers as far apart as possible; and removing all spotted leaves at least fortnightly, while the spots are still light brown.

The disease known as dry rot affects isolated plants and small groups, the leaves of which die back from the margins until the whole plant succumbs. The interior of the corm contains a dry, punky, brownish mass of fungal threads. The condition is caused by various Basidiomycetes, including a species of *Poria*; these live on dead and decaying tree stumps and can infect living banana plants in close proximity.

Stem-end rot or black end usually begins as a dark, water soaked area associated with bruising or injury to the short fruit stalk, which turns black and becomes shrunken and sometimes shredded. The blackened area extends through the skin of the fruit, the pulp becoming soft and watery. The disease usually appears only when the fruit approaches maturity, and especially after long distance consignment. It is associated with the presence of various weak wound parasites, such as species of *Verticillium*, *Gloeosporium*, and *Fusarium*, but the primary cause lies in injuries inflicted on the fruit during handling.

Immature fruits are subject to a disease known as 'cigar end' in which they show a firm black rot at the apex, which shrinks and often becomes rounded, the blackened tissue then becoming covered with an ashy- or pinkish-grey coating of spores. A species of *Verticillium* is usually associated with this condition.

'Squirter' [ibid., iv, p. 556] mainly affects market fruit after long distance transit and is probably associated with physiological disturbances; the centre of the fruit turns to a watery mass after ripening.

Notes are also given on bunchy top, Panama disease (*Fusarium cubense*), and anthracnose (*Gloeosporium musarum*).

DICKSON (B. T.). **Leaf spot of Banana in southern Queensland.**—*Queensland Agric. Journ.*, xxx, 5, pp. 455–457, 1928.

During June and July, 1928, the author made a survey of the banana leaf spot [*Cercospora musae*] situation in southern Queensland [see preceding abstract], in the course of which the disease was found in nearly every plantation visited, and in most was already causing serious loss by preventing the bunches from filling out and injuring the young non-bearing plants.

The leaf spot invasion is regarded as the culmination of a series of troubles due to unfavourable conditions, including ill-drained and unsuitable soil (the plants having a very poor root system in consequence); wet, cool weather; and the attacks of borers.

DAMPF (A.). **No existe en México el 'mal de Panamá' del Plátano.** [The Panama disease of the Plantain does not exist in Mexico.]—*Bol. Mens. Ofic. Def. Agric. Estados Unidos Mexicanos*, ii, 10–11, pp. 638–642, 1 fig., 1928.

In November, 1927, plantains in various districts of Mexico were reported to be suffering from a disturbance which was at first suspected to be Panama disease (*Fusarium cubense*). Affected plants show a drooping and yellow discoloration of the basal leaves, while reddish-yellow to brown, irregular patches of diminishing size extend from the base of the trunk to the tips of the lower shoots. In advanced stages the base of the trunk may turn black and heart rot sets in; this final phase of the disease is characterized by a disagreeable odour resembling that of coco-nut bud rot.

The causal organism of the disease could not be definitely identified in the absence of expert mycological assistance, but *Fusarium* was not found.

HANSEN (H. N.). **Endosepsis and its control in Caprifigs.**—*Phytopath.*, xviii, 11, pp. 931–938, 1 fig., 1 graph, 1928.

In this paper the author discusses the various manifestations of endosepsis (*Fusarium moniliforme* var. *fici*) in caprifigs [*R.A.M.*, vii, p. 104], and describes methods for the control of the disease, which is stated to be responsible for 80 per cent. of the annual loss from disease in the Californian fig industry.

The rapid increase and spread of endosepsis are attributed to the practice of inter-regional distribution of caprifigs; to the prolific nature of the insect, *Blastophaga psenes*, which carries the disease (some 400 individuals being contained in a single caprifig); and to the ability of the latter to fly long distances.

Laboratory and field experiments [which are fully described] indicate that the causal organism may be eliminated from caprifigs either by injecting a fungicide such as will not kill the insects (e.g., 2 per cent. semesan) into young capri or by cutting ripe ones into halves and immersing them for 15 minutes in the disinfectant. The latter method was found to be adaptable to commercial practice by a procedure which is described. The uncontaminated insects are captured in vials and can be transported for use in caprifying over long distances.

LANHAM (W. B.), WYCHE (R. H.), & STANSEL (R. H.). **Spraying for the control of Fig rust.**—*Texas Agric. Exper. Stat. Circ.* 47, 8 pp., 3 figs., 1927.

Fig rust (*Uredo* [*Kuehneola*] *fici*) is stated to cause heavy damage to this important crop in Texas, where the Magnolia variety covers some 16,200 acres. In a series of experiments [details of which are given and the results tabulated] on the control of this disease in 1926, practically no difference was observed in the efficacy of Bordeaux mixture 5–5–50 and 10–10–50. Used as a dormant

spray, Bordeaux mixture failed to control the rust, but when applied to the leaves at the first signs of infection (usually about 15th July), and thenceforward approximately once a month at least until 15th September, it gave excellent results.

IVANOFF (B.). Опити съ минералната сѣра „**Saim**" (Саймъ) противъ нѣкои мани по наши културни растения. [Experiments with the mineral sulphur 'Saim' in the control of some mildews of our cultivated plants.]—*Българско Овощарство* [*Bulgarian Fruit Growing*], ix, 9, pp. 180–184, 6 figs., 1928.

Excellent results are claimed to have been obtained by the author in his experiments in the control of rose mildew (*Sphaerotheca pannosa*), cucurbit mildew (*S. humuli*), and apple mildew (*Podosphaera leucotricha*) with a mineral sulphur obtained in Altovilla Irtina, Italy, and known as ventilato sulphur 'Saim'. The sulphur —an extremely fine, greenish powder—gives a dense cloud of dust which entirely covers the foliage, is not easily washed off by rain, and does not scorch the leaves; a further advantage is that its price is about half that of the ordinary brands of sulphur. It is believed that it will prove equally efficacious against other mildews, such as that of black and red currants [*Sphaerotheca mors-uvae*], hops [*S. humuli*], of the vine [*Uncinula necator*: *R.A.M.*, viii, p. 85], and tobacco [*Oidium tabaci*].

Statens Redskabsprøver 49 Beretning. Vædske-sprederen 'Kartof'. [Forty-ninth Report of the State experiments with equipment. The Kartof spraying apparatus.]—14 pp., 8 figs., Copenhagen, A. Bang's Boghandel, 1928.

Full technical details are given concerning the construction and mode of application of the 'Kartof' spraying apparatus [*R.A.M.*, vii, p. 591.] The results of the official Danish experiments with this machine are stated to have been extremely satisfactory. The weight of the apparatus is 400 kg. and its cost Kr. 585.

Statens Redskabsprøver 50 Beretning. Enkelt- og nyhedsprøver. [Fiftieth Report of the State experiments with equipment. Tests with miscellaneous and new apparatus.]—68 pp., 17 figs., 1 diag., 1 graph, Copenhagen, A. Bang's Boghandel, 1928.

This report contains (pp. 16–21) an account of the official Danish tests with the 'Bursø' dusting apparatus (manufactured by A. Munch Clausen, Bursø). The machine, which is intended for the disinfection of cereal and other seeds, weighs 50 to 75 kg. and costs Kr. 70 or 90, according to size; it gave very satisfactory results in these experiments, and may be recommended for use on a small scale.

MARCHIONATTO (J. B.). **Una fitonosia nueva (La 'koleroga' del Café ?).** [A new plant disease (the Coffee koleroga ?).]—*Physis*, Buenos Aires, viii, 31, pp. 554–557, 2 figs., 1927. [Received 1928.]

Corticium koleroga is stated to occur in the Argentine Republic on various kinds of citrus, *Codiaeum variegatum*, *Cucumis anguria*, *Garcinia mangostana*, *Hevea* rubber, *Luffa aegyptiaca*, *Areca*

catechu, *Albizzia* sp., yerba maté (*Ilex paraguensis*), and *Nerium oleander* [cf. *R.A.M.*, viii, p. 116].

The symptoms of the disease and the morphological characters of the fungus are briefly described. No reproductive organs have been observed on maize meal cultures, and the perpetuation of the fungus appears to occur exclusively by means of the mycelium carried by the wind on diseased leaves.

COSTANTIN (J.). **Une station fongique nouvellement créée dans la forêt de Fontainebleau.** [A new fungal station created in the forest of Fontainebleau.]—*Comptes rendus Acad. des Sciences*, clxxxvii, 19, pp. 784–787, 1928.

In this note the author states that the stations of *Pleurotus eryngii* which have been artificially created in 1925 and subsequent years in the forest of Fontainebleau and in the Ardennes [*R.A.M.*, vii, p. 529] yielded abundant crops of the mushrooms in 1928. In some cases there was evidence that the mycelium had progressed through the soil. These results show the possibility, therefore, of using waste land bearing *Eryngium campestre* for the cultivation of this valuable edible fungus outside its natural area of distribution.

GAVAUDAN (P.). **Sur la présence d'un champignon parasite dans les anthéridies de Marchantia polymorpha et son action sur la gamétogénèse.** [Note on the occurrence of a parasitic fungus in the antheridia of *Marchantia polymorpha* and its action on gametogenesis.]—*Comptes rendus Acad. des Sciences*, clxxxvii, 22, pp. 995–997, 1928.

Examination of certain plants of *Marchantia polymorpha* from the gardens of the Muséum d'Histoire Naturelle in Paris, in which a premature browning of the antheridia had been noted, showed that the affected antheridia were abundantly permeated by hyphae of an undetermined fungus which also occurred at the periphery of these organs. Some of the antheridia had been evidently invaded by the mycelium before the formation of the spermatids, which were either completely destroyed or considerably reduced in size. In some cases, however, infected antheridia contained apparently normally developed antherozoids, while uninfected antheridia frequently occurred side by side with diseased. The fungus also appeared capable of acting on the sexual organs at a distance, since some were observed presenting morphological modifications though no mycelium was to be found in their vicinity. The parasite produced pycnidia containing spores [but no description of these bodies is given].

KILLIAN (C.). **Études comparatives des caractères culturaux et biologiques chez les Deutéromycètes et les Ascomycètes parasites.** [Comparative study of the cultural and biological characters in parasitic Deuteromycetes and Ascomycetes.]—*Ann. Sci. Nat. Bot.*, Ser. X, x, 2, pp. 101–292, 2 col. pl., 36 figs., 3 graphs, 1928.

The main purpose of this investigation was to study the biological and cultural characters of parasitic species of the genus *Ramularia*,

both on their natural substrata and on various synthetic media [the composition of which is given], with particular reference to the response of the fungi to variations in the composition of the latter as exhibited by the formation or suppression of different fruiting forms. Since, however, the genus *Ramularia* is poorly defined, the work was extended to include several allied genera. Furthermore, as none of these fungi produced perithecia on artificial media, the physiology of the latter organs was studied in species of *Hypomyces*. In all, detailed descriptions are given of 17 species of *Ramularia* (in two of which different sub-species or strains are distinguished by trinomials), one species of *Phyllosticta*, five of *Ovularia*, one of *Graphium*, four of *Cercospora*, four of *Septoria*, one of *Phleospora*, three of *Hypomyces*, and one of *Diplocladium*.

A detailed examination was made of the factors favouring the production of conidia, sclerotia, pycnidia, and, in the case of *Hypomyces*, of perithecia. In regard to conidia, the results indicated that their production is favoured by desiccation of the substratum, while excess of atmospheric moisture (such as obtains in culture tubes) favours the development of mycelium and is antagonistic to sporulation. No general rule can be established, however, as the conditions that stimulate the production of conidia vary from one species to another. There was also evidence that the structure of the conidiophores has no taxonomic value, as it depends to a large extent on the nature of the substratum; in some species, e.g., *R. variabilis*, they can occur as subepidermal clumps or emerge through the cuticle of the host. A close genetic relationship was found to exist between sclerotia and pycnidia, since transitional forms from the one to the other were observed on artificial media. As with conidia, environmental and nutritional conditions that determine the production of sclerotia and pycnidia are not constant for all the species studied, and a great part is played in the determination of these organs by the natural properties inherent in each individual species, this being also true for perithecia. The composition of the culture medium appeared, however, to have a considerable bearing on the structure of pycnidia and the size of their spores, thus rendering pycnidia with microspores of little, if any, taxonomic value. The conclusion drawn from these studies is that there is no specific culture medium capable of stimulating the formation of either sclerotia, pycnidia, or perithecia.

A valuable bibliography of nearly two hundred titles is appended.

LUTZ (L.). **Sur le rôle biologique du tanin dans la cellule végétale.** [On the biological rôle of tannin in the plant cell.]—*Bull. Soc. Bot. de France*, Sér. 5, lxxv, 1–2, pp. 9–18, 1928.

It has been shown in recent years, by chemists, that phenolic compounds possess in a high degree the power of inhibiting the spontaneous oxidation of auto-oxidisable bodies. Tannin, whose function in plants has been the subject of much discussion [a review of the literature of which is given], has been proved to be phenolic in constitution, and small quantities added to benzoic aldehyde prevented the oxidation of the latter substance in the presence of oxygen. The oxidising enzymes secreted by Hymeno-

mycetes behave in exactly the same way towards oxidisable or reducible substances as purely chemical catalysts, and in a series of experiments with cultures of *Stereum hirsutum* [cf. *R.A.M.*, viii, p. 193], *S. purpureum*, *Polyporus* [*Polystictus*] *versicolor*, *Polyporus* [*Fomes*] *pinicola*, and *Pleurotus eryngii* on a synthetic medium [the composition of which is indicated], the author found that the addition of five drops of a 1 per cent. tannin solution exerted a markedly antioxygenic action, especially on the first three of these fungi. Two drops of a 0·25 per cent. solution of methylene blue were added to the medium also as an indicator, and this substance turned green after 4 days in the tubes to which tannin was added, as compared with 8 to 15 days in the controls. Experiments were also made with solutions on suspensions of guaiacol, 0·01 per cent.; α naphthol, 0·005 per cent.; and α naphthylamine chlorohydrate, 1 per cent.; one drop of each being added in place of the methylene blue. Coloration of these substances by fungal oxidases was considerably retarded by the presence of tannin (5 days with guaiacol and over a month with the other two compounds). At the same time the tannin developed a marked brown coloration, due to oxidation. Similar results were obtained by substituting gallic acid for tannin.

SURYANARAYANA AYYAR (P. S.). **A method of selecting ring-disease free Potato seeds for planting.**—*Madras Agric. Dept. Year Book, 1927*, pp. 37–42, 1928.

In the Madras Presidency potato cultivation has long been confined to the Nilgiris, where ring disease [*Bacterium solanacearum*] is very prevalent. Good control of this disease was effected in a series of experiments [the results of which are tabulated] by planting selected seed pieces kept protected from wind or sun for 24 hours after cutting. This method facilitates the immediate rejection of tubers showing the slightest discoloration of the tissues, while promoting the healing of the cut surfaces of the tubers, and it resulted in a reduction of the disease.

Die Gefahr einer Einfuhr des Kartoffelkrebses durch den Handel in Oberösterreich. [The risk of an introduction of Potato wart through trade in Upper Austria.]—*Wiener Landw. Zeit.*, lxxviii, 45, p. 403, 1928.

Attention is drawn to the recent introduction of potato wart [*Synchytrium endobioticum*] into the Kitzbühel district (Austrian Tyrol) [*R.A.M.*, viii, p. 57]. The infected material was imported by a firm at Linz from Czecho-Slovakia, and was accompanied by the requisite certificate of health. It is suggested that, owing to the extremely rapid spread of wart disease in Czecho-Slovakia of recent years, the phytopathological experts can no longer definitely guarantee the origin of any given consignment in a healthy area, and consequently Austrian growers are strongly discouraged from purchasing Czecho-Slovakian potatoes for seed.

KÖCK (G.). **Der Kartoffelkrebs in Oesterreich.** [Potato wart in Austria.]—*Wiener Landw. Zeit.*, lxxviii, 43, pp. 385–386, 2 figs., 1928.

A brief, popular account is given of the spread of potato wart

[*Synchytrium endobioticum*] in Austria since the first notification of the disease in 1925, and of the legislative and other measures adopted for its control [see preceding abstract]. It is considered very doubtful whether the soil disinfection experiments now in progress will give any results of permanent value.

KÖCK [G.]. **Bodendesinfektionsversuche zur Bekämpfung des Kartoffelkrebses.** [Soil disinfection experiments in the control of Potato wart.]—*Oesterr. Zeitschr. für Kartoffelbau, 1928*, 4, pp. 2–5, 1 diag., 1928.

In 1927 the results of soil disinfection experiments against potato wart [*Synchytrium endobioticum*: *R.A.M.*, vii, p. 664, and preceding abstracts] were sufficiently encouraging to justify further trials. In 1928, however, neither 1 per cent. formaldehyde nor 0·5 per cent. uspulun proved efficacious. The Jubel variety remained immune in these tests.

K[ÖCK (G.)]. **Neue Kartoffelkrebsvorkommen in Oesterreich.** [New records of Potato wart in Austria.]—*Oesterr. Zeitschr. für Kartoffelbau, 1928*, 4, pp. 1–2, 1928.

Details are given concerning the most recent outbreaks of potato wart [*Synchytrium endobioticum*] in Austria [see preceding abstracts]. In one locality the affected plots mostly contain the Schneeflocken, Blaue Riesen, and English varieties. Fresh occurrences of the disease are reported from Vorarlberg and the Tyrol.

CHEAL (W. F.). **The black dot fungus of Potatoes.**—*Gard. Chron.*, lxxxiv, 2192, pp. 508-509, 2 figs., 1928.

The black dot disease (*Colletotrichum atramentarium*) [*R.A.M.*, vii, p. 391] is believed to have caused the premature death of the haulms and consequent reduction in yield of a crop of King Edward potatoes near Spalding, Lincs. The sclerotia of the fungus were abundant on the 'heel' ends of the tubers, this being apparently the first record of their occurrence on these organs in England. They were also detected later on tubers from Holbeach and Boston.

REILING (H.). **Die Dürrfleckenkrankheit der Kartoffel.** [The dry spot disease of the Potato.]—*Deutsche Landw. Presse*, lv, 47, pp. 683–684, 5 figs., 1928.

A brief, popular description is given of the symptoms of early blight of potatoes (*Alternaria solani*), which is stated to have occurred in a severe form on the Geheimrat Walter, Arnica, Belladonna, Allerfrüheste Gelbe, Present, Magdeburger Blaue, and Ally varieties in Germany during 1928. Observations on plants raised from seed by breeders indicate that susceptibility to *A. solani* is, in the first instance, an hereditary character, environmental and meteorological factors being of secondary importance. Under conditions favouring the spread of infection, early blight may cause very considerable damage by destroying the assimilatory substance of the leaf and thereby reducing the yield of tubers and starch.

SZELENYI (G. v.) & BECZE (G. v.). **Beiträge zur Kenntnis der Enzymwirkung von Alternaria solani.** [Contributions to the knowledge of the enzymatic action of *Alternaria solani.*]—*Centralbl. für Bakt.*, Ab. 2, lxxvi, 1–7, pp. 121–124, 1928.

The authors describe the methods and tabulate the results of their experiments, conducted at the Botanical Institute of the Budapest Technical University, to determine the assimilative capacity and enzymatic action of *Alternaria solani* during its vegetative period. The cultures tested were obtained from the Centraalbureau at Baarn. Large quantities of saccharose, maltose, lactose, and starch were utilized, raffinose was assimilated to a lesser extent, while inulin, melezitose, salicin, and amygdalin remained untouched, and dextrose was dissolved. Saccharase, maltase, and lactase were found as exoenzymes in *A. solani,* while the only endoenzyme definitely identified was invertase.

HEMMI (T.) & YOKOGI (K.). **Experimental studies on the pathogenicity of certain fungi on Rice seedlings.**—*Mem. Coll. Agric., Kyoto Imper. Univ.*, 7, pp. 1–22, 2 pl., 1 graph, 1928.

The results of a series of inoculation experiments carried out on disease-free seedlings on nutrient agar in flasks and tubes confirmed the existence of a group of fungi capable of causing foot and root rot of rice plants under the conditions of the tests.

The organisms used were common rice pathogens isolated from the ariel parts of the plants, e.g., *Piricularia oryzae* [*R.A.M.*, viii, p. 197], *Helminthosporium oryzae* [ibid., vii, p. 668], *Hypochnus* [*Corticium*] *sasakii, H. centrifugus* [*C. centrifugum*: ibid., vii, p. 266], *Sclerotium oryzae* [ibid., viii, p. 59], and Sakurai's *S.* No. 2 (*Ehime Agric. Exper. Stat. Bull.* 1, 1917). Of these fungi, *H. oryzae* was found to penetrate the root tissues with the greatest facility, causing a serious blight of the basal portions of the seedlings. Next in order of virulence came *P. oryzae*, the incidence of infection and degree of pathogenicity in the sclerotial fungi being considerably less.

It is pointed out that these observations apply only to the particular conditions governing the trials under discussion, and that they do not necessarily represent the exact course of development in nature. It is safe to assume, however, that the plants are liable to infection by a number of fungi when grown under conditions favouring the development of the latter.

A bibliography of 41 titles is appended.

HEMMI (T.) & ENDO (S.). **On a staining method for testing the viability of sclerotia of fungi.**—*Mem. Coll. Agric., Kyoto Imper. Univ.*, 7, pp. 39–49, 1 pl., 1928.

In their studies on the diseases of rice the writers found by experiments [which are described] that the viability of sclerotia could be determined by staining with a 1 per cent. aqueous solution of eosin or 1 to 2 per cent. acid fuchsin, the dead tissues taking on a deeper colour than the living. For sclerotia with hyaline tissues, e.g., those of *Sclerotinia libertiana* [*S. sclerotiorum*], *Hypochnus centrifugus* [*Corticium centrifugum*], and Sakurai's *Sclerotium* No. 2 [see preceding abstract], macroscopical examination was

sufficient, but for those with coloured tissues, such as those of *H.* [*C.*] *sasakii* and *S. oryzae*, the method can only be used microscopically. The staining reaction was the same whether the sclerotia were killed by heating in boiling water or in a dry oven at 80° C.; or by immersion in alcohol, chloroform, formalin, acetic acid, or 10 per cent. caustic soda; or by fumigation with carbon disulphide.

SETO (F.). **The reactions of Rice seedlings to infection of the causal fungus of the 'bakanae' disease and to filtrates of its cultures.**—*Mem. Coll. Agric., Kyoto Imper. Univ.*, 7, pp. 23–38, 2 pl., 1928.

This is an English version of the writer's Japanese paper on the 'bakanae-byô' disease of rice, associated with a strain of *Fusarium*, a notice of which has already appeared from another source [*R.A.M.*, viii, p. 197].

MILLASSEAU [J.]. **Présence du Gibberella saubinetii sur des Houblons atteints de 'canker'.** [The presence of *Gibberella saubinetii* on hops attacked by canker.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 8, pp. 235–237, 1 pl., 2 figs., 1928.

Cuttings of hops from England planted in an experimental hop garden in France mostly failed to develop, and in particular the varieties Bates Brewer and Petham Golding were almost entirely destroyed. The disease resembled that known in England as canker [*R.A.M.*, ii, p. 132; iv, p. 634], and the affected plants also showed, as in that country, a rose-coloured *Fusarium* growth. Some of the buds developed into shoots 3 or 4 cm. long, which, however, were killed before they emerged. Near the surface of the soil were found numerous blue perithecia, 240 by 170 μ in diameter, with asci 65 by 10 μ, containing 8 fusiform or slightly curved, 3-septate ascospores, measuring 20 by 4 μ. The author refers the fungus to *Gibberella saubinetii* and the *Fusarium* form with 5-septate spores, measuring 29 to 35 by 4 to 5·5 μ, to *F. roseum*. This is stated to be the first record of the disease on hops in France.

UPPAL (B. N.). **India: Sclerotium rot of Betel Vine (Piper betle) in Bombay Presidency.**—*Internat. Rev. of Agric.*, N.S., xix, 12, p. 1076, 1928.

Attention is drawn to the very serious nature of the *Sclerotium* rot of betel vines (*Piper betle*), caused by *S. rolfsii*, in the Bassein district of the Bombay Presidency [*R.A.M.*, viii, p. 156]. Soil disinfection experiments are planned for the control of the disease, which also occurs on a number of other important crops.

EDGERTON (C. W.). **Disease resistance of P.O.J. 213 Cane.**—*Sugar Bull.*, 15th November, 1928. [Abs. in *Facts about Sugar*, xxiii, 50, p. 1190, 1928.]

The sugar-cane diseases of economic importance in Louisiana are enumerated [*R.A.M.*, vi, p. 641; vii, p. 59]. P.O.J. 213 is virtually immune from mosaic [ibid., viii, p. 62] and highly resistant to most of the other diseases found locally. The other P.O.J. numbers, viz., 234, 36, 2714, 2727, 2725, and 826, are markedly susceptible to one or more of these diseases. P.O.J. 228 is some-

what susceptible to top rot, but otherwise approaches P.O.J. 213 more closely in disease resistance than any of the remaining varieties tested.

LEE (H. A.) & PIERCE (W. D.). **Bacterial red stripe disease of Sugar Cane in countries of the Pacific.**—*Phytopath.*, xviii, 11, p. 945, 1928.

Bacterial red stripe disease of sugar-cane [*Phytomonas rubrilineans*: *R.A.M.*, vii, p. 741] was first recorded in 1924 from Hawaii, where the susceptible Tip varieties are gradually being superseded by higher-yielding canes. The bacterial red streak disease reported in 1926 from Queensland by Cottrell-Dormer [ibid., v, p. 696] appears to be the same, as is also that recorded on the D. 74 variety in Louisiana by Edgerton and Christopher in 1927 [ibid., vii, p. 59], while Miss Bolle has recently described its occurrence on P.O.J. 2722 in Java [ibid., vii, p. 537]. Bacterial red stripe has now been found on P.O.J. 2883 in the Philippines. It would appear, therefore, that the disease is fairly general in the Pacific countries, but it is of little commercial importance, since most of the standard varieties are highly resistant to it.

BOOBERG (G.). **De red-stripe disease.** [The red stripe disease.]—*Arch. Suikerind. Nederl.-Indië*, II Deel, xxxvi, 51, pp. 1246–1250, 1928.

In connexion with the increasing prevalence of red stripe disease [*Phytomonas rubrilineans*] in Java [see preceding abstract], the writer summarizes the results of Hawaiian investigations on this subject and adds some notes on his own recent observations.

The disease has been found on the P.O.J. 2722, 2878, 2952, 2946, and 2947 varieties, the last-named being highly susceptible. Cases of over 50 per cent. infection are common in plantations of this variety, which constitutes a serious source of contamination to the surrounding fields. Heavily infected plantations of this variety should be ploughed up. P.O J. 2878 is less susceptible and usually survives an attack of red stripe; it is, however, liable to top rot (pokkah boeng) [ibid., vii, p. 403; viii, p. 134] when simultaneously infected by *P. rubrilineans* and *Fusarium*.

Although the risk of the transmission of red stripe through the setts is considered in Hawaii to be very slight, the writer recommends the immediate destruction of diseased material by burning on the spot. Cane leaves used for packing should not be brought into the nurseries but burnt at once.

BOOBERG (G.). **Bestrijding van red-stripe disease in bibittuinen.** [Control of red stripe disease in nurseries.]—*Arch. Suikerind. Nederl.-Indië*, I Deel, xxxvii, 2, pp. 37–38, 1929.

Recent observations having shown that red stripe disease of sugar-cane (*Phytomonas rubrilineans*) occurs almost exclusively in the vicinity of paths and trenches in Java plantations, the writer again urges the importance of burning infected material on the spot [see preceding abstract]. This applies primarily to the P.O.J. 2878, 2952, and 2946 varieties; 2722 and 2947 should be ploughed up.

CARPENTER (C. W.). **Notes on Pythium root rot.**—*Hawaiian Planters' Record*, xxxii, pp. 461–474, 1928. [Abs. in *Facts about Sugar*, xxiv, 1, p. 15, 1929.]

Evidence has been obtained that the susceptibility of Lahaina cane to root disease is an acquired condition resulting from the absorption of soluble substances. The latter are present in cane trash composted with adco, especially when this compost is used on virgin soils. Excess of sodium nitrate, either alone or in association with cane residues, was found to induce susceptibility to *Pythium* rot [*R.A.M.*, iii, p. 484]. The disintegration and decomposition of cane trash, stubble, and roots in the soil in hot weather when the moisture is at a minimum produce effects similar to those of composting with adco.

[UPPAL (B. N.).] **Control of the red rot of Sugarcane.**—*Bombay Dept. of Agric. Leaflet* 7, 3 pp., 1928.

This leaflet (superseding No. 1 of 1910) contains brief, popular notes on red rot [*Colletotrichum falcatum*], which is described as undoubtedly the most destructive and widespread disease of the sugar-cane in the Bombay Presidency. Canes growing on water-logged or poorly drained soils are particularly liable to infection by red rot, which also attacks plants weakened by insect invasion. The disease may be spread by clumps of cane left to wither in the field after harvest. Control measures should be based on the removal of all débris; the use of healthy seed for planting; the cultivation of resistant varieties; and the ploughing up and exposure to the sun of infected soils, in which the fungus can only persist for some three months.

MARTIN (J. P.). **Control of eye spot disease.**—*Hawaiian Planters' Record*, xxxii, pp. 391–394, 1928. [Abs. in *Facts about Sugar*, xxiv, 1, pp. 14–15, 1929.]

Eye spot of sugar-cane [*Helminthosporium sacchari*] in Hawaii has a definite season beginning in October and ending in March [*R.A.M.*, vii, pp. 807, 808]. Observations on H. 109 cane have shown that the older the crop is on entering this period, the greater is its resistance to the disease. Hence it is recommended that all fields subject to eye spot should be planted during March and April, so that the canes may make a good start before the beginning of the next period of infection. Fertilizers should also be applied so as to avoid inducing rapid succulent growth during the eye spot season. The disease generally appears year after year in localities offering favourable conditions for the development of the causal organism. The ultimate solution of the problem presented by this disease lies in the production of a resistant and prolific variety.

PETCH (T.). **Tropical root disease fungi.**—*Trans. Brit. Mycol. Soc.*, xiii, 3–4, pp. 238–253, 1928.

In this paper notes are given on the nomenclature of some fungi causing the principal root diseases of plantation crops in the

eastern tropics. A review of the descriptions and figures which have been published shows that the *Armillaria* root diseases in Ceylon, Java, and West Africa [*R.A.M.*, vi, p. 659; viii, p. 202] are caused by the same species, *A. fuscipes*, described by the author in *Ann. Roy. Bot. Gard. Peradeniya*, iv, p. 299 [1909]. This fungus is undoubtedly the tropical analogue of *A. mellea*, but is believed to be distinct from the latter, as it differs from it in the smaller number of carpophores emerging from the basal cushion, their more slender habit, the practically white colour of the pileus, which is brown or yellow-brown only in the centre, where there are also a few, minute, distant brown warts, and the blackish-brown- or sepia-coloured floccose stalks.

Ustulina zonata [*R.A.M.*, iv, p. 68; viii, p. 69] is considered to be the tropical form of *U. vulgaris*, and according to the International Rules on nomenclature, both species should be known under the prior name *U. deusta*.

The two red root diseases which are known to occur in Ceylon are caused by two distinct species, namely, *Poria hypolateritia* (chiefly on tea) and *P. hypobrunnea* (chiefly on *Hevea*), respectively. *P. hypobrunnea* somewhat resembles the *Poria* forms of *Fomes pseudoferreus*, but Miss Wakefield considers the latter distinct, and besides, the action of the two fungi on the roots of *Hevea* is different. The red root disease of *Hevea* in Malaya is caused by *F. pseudoferreus*, while that in Java and Sumatra is caused by a species of *Ganoderma*. Van Overeem's view [ibid., v, p. 54] that the latter is identical with *F. pseudoferreus* of Malaya and his renaming this fungus *G. pseudoferreum* are not accepted, since he does not appear to have compared specimens from the two countries. Likewise, Van Overeem's and Steinmann's transference of *Fomes ferreus* to the genus *Ganoderma* as *G. ferreum* [ibid., iii, p. 423] is considered incorrect, since examination of specimens showed that this fungus is not a *Ganoderma* and is not connected with a red root disease. In the author's opinion *F. ferreus* is identical with the later *Polyporus semilaccatus*, under which name it has been reported from Ceylon, and it is a *Polyporus*, not a *Fomes*.

The conclusion drawn from a full account of the taxonomy of *Fomes lignosus* [ibid., viii, p. 72] is that the fungus that causes white root disease of rubber in the East is not *Polyporus microporus*, and, if Lloyd's identification of the latter with the real *F. lignosus* Klotsch is correct, it cannot be *F. lignosus*. It would therefore appear that the fungus is really an unnamed species, since none of the names that have been applied to it is the right one.

González Fragoso (R.) & Ciferri (R.). **Hongos parásitos y saprofitos de la República Dominicana (11a, 12a, 13a, 14a, 15a series).** [Parasitic and saprophytic fungi of the Dominican Republic. (Series 11 to 15).]—*Estac. Agron. de Moca, Ser. B—Botán.*, 11, 79 pp., 36 figs., 1928.

In this paper five of the authors' contributions to the knowledge of the parasitic and saprophytic fungi of the Dominican Republic are reprinted in a condensed form [*R.A.M.*, vii, p. 673].

MARCHIONATTO (J. B.). **Fitoparásitos de la Argentina nuevos o poco conocidos. II.** [New or little-known plant parasites of the Argentine. II.]—*Physis*, Buenos Aires, ix, 32, p. 145, 1928.

This is a résumé of the author's second list of new or little known plant diseases occurring in the Argentine Republic. *Phyllosticta glaucispora* has been found on oleander [*Nerium oleander*]; *Phoma citricarpa* on lemon; *Septoria graminum* on oats; *S. melissae* on balm gentle [*Melissa officinalis*]; *Pleospora ulmi* (Fr.) Wallr. on European elm; *Fusicladium* [*dendriticum* var.] *eriobotryae* on Japanese medlar [*Eriobotrya japonica*]; *F. pirinum* var. *pyracanthae* on *Crataegus pyracantha*; *Cercospora cerasella* on mazzard [*Prunus cerasus*] and cherry; and *C. neriella* on *N. oleander*.

HIRATSUKA (N.). **Additional notes on the Melampsoraceae of Hokkaido.**—*Bot. Mag.*, Tokyo, xlii, 503, pp. 503–504, 1928.

In this paper the author adds two species to the Melampsoraceae of Hokkaido (Sapporo, Japan) [*R.A.M.*, vii, p. 405], one of which, *Phakopsora ampelopsidis*, is recorded on *Vitis coignetiae*. Among new hosts the aecidial stage of *Melampsorella caryophyllacearum* is recorded on *Abies sachalinensis* [cf. ibid., vi, p. 453].

DUKE (MAUD M.). **The genera Vermicularia Fr. and Colletotrichum Cda.**—*Trans. Brit. Mycol. Soc.*, xiii, 3–4, pp. 156–184, 1 pl., 11 figs., 1928.

A critical study of the history of the genera *Vermicularia* and *Colletotrichum* and a comparative examination of the structure of authentic specimens of both lead the author to conclude that no essential difference exists between them. Examination of Fries's own material of *V. dematium* indicated that he based this genus on a misconception of its structure, since sections of the pustules showed a fairly large, dark brown, erumpent, setose, pulvinate stroma, whose uppermost portion was differentiated as a palisade-like layer of conidiophores bearing conidia, the conclusion being that he mistook this stroma for a pycnidium. Further, Corda's description and diagrams of *C. lineola* suggest the possibility that this fungus is identical with *V. dematium*, and that, therefore, the genera *Vermicularia* and *Colletotrichum* were based on the same fungus. For all these reasons it is proposed to combine the two genera into one, and to conserve the later name *Colletotrichum* for the sake of convenience, since it is more widely known among pathologists than *Vermicularia*. This genus is characterized by an innate acervulus which later becomes erumpent, dark brown setae, and elongated, oblong or fusiform, curved or straight conidia. Species with few, or at times, no setae are not typical and are regarded as transitional to *Gloeosporium*. The genus *Volutella* is shown to be distinct from *Colletotrichum*; it is characterized by its superficial origin, hyaline setae, and smallish oval spores.

The paper terminates with critical notes, and in some cases, a description of cultural characters of the following species: *C. dematium*, *C. eryngii*, *C. liliacearum*, *C. trichellum*, *C. holci*, and of two new species, namely, *C. lysimachiae* and *C. wahlenbergiae* on *Lysimachia nemorum* and *Wahlenbergia* sp., respectively.

LIND (J.). **Nogle danske Mikromyceter.** [Some Danish Micromycetes.]—*Dansk Bot. Arkiv*, v, 18, 7 pp., 1928.

Notes are given on 61 species of fungi new for the Danish flora, of which the following may be mentioned. *Pyrenophora trichostoma* (Fr.) Fuck. was found in two localities on dead straw of *Triticum repens*. The perithecia and spores are considerably larger than those of the Pleosporaceae in general; the spores measure 38 to 44 by 15 to 16 μ and have only three cross walls and one longitudinal septum. This species is considered to be identical with *Pleospora culmorum* (Cke) Sacc.

Caeoma ari-italici, hitherto known only from southern and southern-central Europe, was found on leaves of *Arum maculatum*. Presumably this *Caeoma*, like that occurring on *Allium* leaves, is genetically related to a species of *Melampsora* on *Salix* [but see *R.A.M.*, viii, p. 144].

Phyllosticta tabaci [ibid., vii, p. 548] was found on living leaves of *Nicotiana rustica*.

Vermicularia graminum, which is characterized by hyaline spores measuring 15 to 18 by 4 to 5 μ, occurred on dead straw of *Calamagrostis epigeios*. *V. eupyraena*, found on dead potato stalks, belongs to the *Vermicularia* group having closed pycnidia covered with stiff setae in place of open, cup-shaped pycnidia [see preceding abstract]. The spores measure 18 by 5 μ.

Cylindrosporium brassicae (*Cercosporella albomaculans*) [ibid., iii, p. 688] was observed in many places on the leaves of cultivated swedes.

PERRIN (O.) & OSMAN (A.). **Lutte contre les ennemis du Tabac.** [Campaign against Tobacco pests.]—*Rev. Tech. du Monopole des Tabacs*, i, pp. 27–29, 1928. [Abs. in *Centralbl. für Bakt.*, Ab. 2, lxxvi, 8–14, pp. 285–286, 1928.]

The two principal diseases of tobacco seedlings in Turkey are stated to be damping-off (*Bacillus fluorescens liquefaciens*, *Rhizoctonia* [*Corticium*] *solani*, and *Pythium de Baryanum*) and root root (*Thielavia basicola*). The cultural measures recommended for the control of the former include sparse sowing (not more than ¼ gm. of seed per sq. m. of seed-bed), plentiful but not too frequent watering, and choice of healthy sites with a suitable exposure [cf. *R.A.M.*, vii, p. 348]; these should be supplemented where necessary by soil disinfection with formalin (2 l. per 100 l. of water).

Root rot is a very serious disease, but in its incipient stages the symptoms are so slight that they may easily be overlooked. All affected seedlings should be destroyed, and if the disease appears in the field after transplanting, the cultivation of tobacco on the infested site should be suspended for several years. Cereals may be grown in place of tobacco, but not beans, lucerne, or other leguminous hosts of the fungus.

D'ANGREMOND (A.). **Jaarverslag over de twee-jarige periode van 1 Mei 1926–30 April 1928.** [Biennial report for the period from 1st May, 1926, to 30th April, 1928.]—*Proefstat. Vorstenlandsche Tabak, Meded.* 61, pp. 1–131, 1928.

Attempts have been made to control the lanas disease of tobacco

(*Phytophthora nicotianae*) [*R.A.M.*, vi, p. 60] by the disinfection or omission of the 'dessa' [village refuse] manure commonly used on the local estates. The former process may be accomplished (*a*) by treatment with carbon disulphide or (*b*) by stacking the fresh manure in heaps and allowing it to ferment. The carbon disulphide treatment costs about Fl. 10 [16*s*. 8*d*.] per bouw [roughly 0·71 hect.], and has hitherto only been applied on one estate. The self-fermentation method is more widely practised and has given satisfactory results with quite fresh manure. It is less reliable, however, with old manures or with those containing only a low proportion of organic constituents. The results of experiments conducted by P. M. Bartels showed that the best yields were given by plots receiving organic manure plus lime, while sulphate of ammonia combined with double superphosphate also proved very beneficial. On the plots treated with the latter fertilizers it was possible to dispense with dessa manure for five years.

Good control of tobacco mildew (*Oidium* sp.) [? *Erysiphe cichoracearum*] has again been obtained by sprinkling the ground with finely ground sulphur at a very early stage of the disease [ibid., vi, p. 516]. The alleged susceptibility to mildew of the E. K. variety appears to be correlated with its luxuriant habit of growth, which facilitates the spread of the fungus.

Fortieth Annual Report of the Kentucky Agricultural Experiment Station for the year 1927, 41 pp., 1928. [Received January, 1929.]

In the section of this report (pp. 15–17) dealing with tobacco diseases it is stated that figures for three years show that virus infection following setting in the field averaged about 7 per cent., when the men pulling the seedlings chewed natural leaf tobacco [cf. *R.A.M.*, vii, p. 477], but was reduced to 0·44 and 0·05, respectively, in two years, when only steam-sterilized tobacco was chewed. Plants pulled by the same men while chewing infected natural leaf tobacco and making no special effort to contaminate the fingers developed 4 to 5 per cent. mosaic. When the fingers were purposely contaminated infection rose to 80 per cent.

Inoculation of Burley tobacco at setting time with a mild strain of true tobacco mosaic reduced the yield by almost 50 per cent. and the value of the crop by 60 per cent. Inoculation at topping time did not affect the yield but reduced the value of the crop by 25 per cent., mainly owing to the production of a darker colour in the cured product.

Economically important virus diseases of tobacco at present known in Kentucky include five apparently distinct strains of true mosaic [loc. cit.], 'etch', 'etch +', 'severe etch', vein-banding (possibly a very mild strain of etch), ring spot [ibid., viii, p. 139], 'coarse etch', one apparently identical with 'healthy potato virus' [ibid., vii, p. 767], 'puff' (apparently identical with cucumber mosaic), and severe puff, which also causes cucumber mosaic. Ring spot was transferred from naturally infected mosaic cucumber plants to tobacco, and it is therefore considered that cucumber may be a source of the disease in tobacco. Apparently only true tobacco mosaic is carried in dry tobacco.

Much of the spotting, both of dark and Burley tobacco, previously attributed to blackfire or angular leaf spot (*Bacterium angulatum*), was found to be physiological. These spots are marked by concentric rings, which seldom, if ever, are seen in angular leaf spot. They developed also on Turkish tobacco plants growing in a greenhouse in pots of unmanured, heavily nitrated soil, though others in similar manured soil remained unaffected.

CLINTON (G. P.) & MCCORMICK (FLORENCE). **Tobacco mosaic.**— [*ex* Report of Tobacco Station at Windsor 1927.]—*Connecticut Agric. Exper. Stat., Tobacco Stat. Bull.* 10, pp. 75 T–82 T, 1928.

This is a general survey of the present state of knowledge concerning various important aspects of the tobacco mosaic problem, e. g., symptoms, etiology, and control. The known facts regarding the disease are briefly summarized in the light of recent information.

HICOCK (H. W.) & ANDERSON (P. J.). **Prolonging the life of Tobacco shade tent poles.**—*Connecticut Agric. Exper. Stat., Tobacco Stat. Bull.* 9, pp. 2T–12T, 1 fig., 5 diags., 1927. [Received January, 1929.]

Every year some of the 350,000 chestnut poles used to support the tobacco shade tents in the Connecticut Valley require replacement owing to decay. The chestnut supply, however, is steadily diminishing on account of blight [*Endothia parasitica*: *R.A.M.*, viii, p. 77], and in time it will probably be necessary to substitute other kinds of wood. In the meantime, the life of the available chestnut poles may be prolonged by treatment with coal-tar creosote or one of its derivatives. Directions are given for impregnation by the open tank method, in which the butts of the poles are immersed in a hot bath (220° F.) for three hours and then transferred to a cool one (100°) for one to two hours. Poles treated in this way may be expected to last for ten years or more.

Legislative and administrative measures. Spain.—*Internat. Rev. of Agric.*, N.S., xix, 12, p. 1079, 1928.

The Royal Ordinance No. 188, dated 27th August, 1928, defines the regulations governing the phytopathological inspection of plant products for importation into Spain and for foreign export. No certificates of inspection will be issued in respect of consignments of plants infected by a disease not already known to occur or not widely spread among Spanish crops.

Report of the Federal Horticultural Board for the fiscal year ended June 30, 1928, 42 pp., 1928.

By a reorganization, effective as from 1st July, 1928, all the plant quarantine and related regulatory and control activities of the United States Department of Agriculture are grouped into one unit, designated the Plant Quarantine and Control Administration, the appropriation for which, during the fiscal year 1929, is increased to $2,971,050, apart from a special appropriation of $5,000,000 for

quarantine and control work in connexion with the pink bollworm pest of cotton [*Platyedra gossypiella*].

In addition to plant quarantine and regulatory duties, the new administration is charged with the enforcement of the Insect Pest Act of 1905, and, in co-operation with the Post Office Department, of the Terminal Inspection Act of 1915, and of the Act of 1926 authorizing the inspection and certification of exports to meet the sanitary requirements of foreign countries. The functions of the Federal Horticultural Board are to be taken over by the new administration, the chief of which is to serve *ex officio* as chairman of an advisory Federal Plant Quarantine Board of five members, the four others being appointed by the Secretary of Agriculture from existing Bureaux and offices of the Department of Agriculture, including the Bureau of Entomology, the Bureau of Plant Industry, and the Forest Service.

Quarantine on account of the Woodgate rust. Notice of Quarantine No. 65, with regulations.—*U.S. Dept. of Agric., Plant Quarantine and Control Admin. Leaflet*, 3 pp., 1928.

In order to prevent the spread of the Woodgate rust (*Peridermium* sp.) [*R.A.M.*, vii, p. 481], no trees, branches, limbs, or twigs of Scotch pine (*Pinus sylvestris*) and other hard pines [which are listed] may be moved to any other part of the United States from a regulated area in the State of New York comprising nine counties. This regulation is effective as from 1st November, 1928.

Decreto por el cual se establece la cuarantena exterior Num. 8 contra las especies y variedades de Trigo (Triticum spp.). [Decree establishing foreign quarantine No. 8 against species and varieties of Wheat (*Triticum* spp.).]—*Bol. Mens. Ofic. Def. Agric. Estados Unidos Mexicanos*, ii, 10–11, pp. 633–635, 1928.

As from 30th October, 1928, the importation into Mexico of all species and varieties of wheat grown in India, Japan, China, Australia, South Africa, Italy, Spain, and the States of Illinois, Kansas, and Missouri is absolutely prohibited in order to prevent the introduction of flag smut (*Urocystis tritici*). Special permits may be obtained for the importation of wheat from the above-mentioned countries for scientific purposes.

Legislative and administrative measures. Peru.—*Internat. Rev. of Agric.*, N.S., xix, 12, p. 1082, 1928.

A Presidential Decree of 1 June, 1928, established the 'Junta de Sanidad Vegetal' [Committee of Plant Sanitation], in connexion with the Ministry of Public Works, to act as an informative, consultative, and executive body in all matters relating to plant protection in the Republic of Peru. It was further ordained on the same date that the importation of plants, cuttings, or seeds into Peru may only take place under permit from the Department of Agriculture of the Ministry of Public Works.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW
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SHAPOVALOV (M.) & BEECHER (F. S.). **The development of Tomato yellows under different light conditions.**—Abs. in *Phytopath.*, xviii, 11, p. 950, 1928.

Experiments in the artificial shading of tomato plants, which tended to lower the rate of evaporation, reduced the incidence of yellows (formerly known as western yellow blight) [*R.A.M.*, vii, p. 478; viii, p. 84] even when the tomatoes were artificially inoculated before shading. There are also indications that the disease is favoured to some extent by low relative humidity. A reduction of light caused a prolongation of the incubation period in the host; an acceleration of plant growth; an alleviation of the disease symptoms; and a lowering of the percentage of infection.

BARKER (J.). **Cold storage trials with Tomatoes.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1927*, pp. 43–44, 1 graph, 1928.

Experiments on a small scale with Riverside and Manx Marvel tomatoes showed that when stored for more than a short time at temperatures below 50° F. they failed to ripen normally and on removal to ordinary temperatures decayed rapidly owing to attack by *Botrytis cinerea*.

BEAUVERIE (J.). **Au sujet de l'oïdium du Chêne.** [On the *Oidium* of the Oak.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 9, pp. 263–264, 1928.

During 1927 and 1928 the perithecia of the oak mildew (*Microsphaera quercina*) [*R.A.M.*, vi, p. 326; vii, pp. 206, 290] were observed quite commonly in the Rhone and Saône valleys, and near Serrières de Briord (Ain) The fungus appears to have become completely acclimatized in France.

BARRETT (J. T.). **Phytophthora in relation to crown rot of Walnut.**—Abs. in *Phytopath.*, xviii, 11, pp. 948–949, 1928.

Crown rot of English walnut trees (*Juglans*) [*regia*] has been under observation for about five years [in California: *R.A.M.*, vii, p. 16]. The lesions are at first confined to the collar and to the

basal part of the roots of the California black walnuts used as stocks. The southern black species (*J. californica*) seems more susceptible than the northern (*J. hindsii*). The white or English root is very resistant. The crown rot lesions may extend on to the trunk following girdling of the collar and a weakened condition of the tree. *Phytophthora cactorum* has repeatedly been isolated from these trunk lesions and inoculated into both the black and English species of walnut with positive results.

FERDINANDSEN (C.) & ROSTRUP (O.). **Om den rette systematiske Stilling af Discomycopsis rhytismoides Jul. Müller.** [On the correct systematic position of *Discomycopsis rhytismoides* Jul. Müller.]—*Dansk Bot. Arkiv*, v, 20, 10 pp., 1 pl., 5 figs., 1928. [German summary.]

In August, 1916, the writers investigated a severe attack of the fungus described by J. Müller (*Pringsheims Jahrb.*, xxv, 1893) as *Discomycopsis rhytismoides* on young sycamore (*Acer pseudoplatanus*) trees near Copenhagen. This fungus was regarded by von Höhnel as synonymous with *Rhytisma acerinum* [*R.A.M.*, iv, p. 385], but a superficial inspection of the diseased leaves showed that this determination was incorrect. The spots produced by *D. rhytismoides* are ill defined, sinuate-angular to irregular, with a marked tendency towards convergence, whereas those of *R. acerinum* are yellow bordered, mostly circular, and scattered.

An examination of the mature *Discomycopsis* stroma plainly showed that the 'septate parallel hyphae' in the loculi, described by Müller as incipient *Discomycopsis* spores, are actually young asci with ripening spores. The asci are at first broadly sac-shaped, later cylindrical, and measure 50 by 6 to 7 μ; while the irregularly biseriate, ellipsoid to oval, hyaline, very unequally bicellular ascospores, with the smaller cell above, measure 10 to 11 by 5 to 5·5 μ. These characters indicate that the sycamore fungus should be referred to the genus *Euryachora*, and it is accordingly renamed *E. rhytismoides* (J. Müll.) comb. nov. (a Latin diagnosis being given).

Muller's '*Discomycopsis* spores', measuring 20 to 28 μ in diameter, were found in old stromata; they are apparently those of a Phycomycete which commonly, if not constantly, accompanies *E. rhytismoides*. The latter is apparently of rare occurrence, as it has hitherto been reported only from the Sudetic Alps and north Zealand.

NATTRASS (R. M.). **The Physalospora disease of the basket Willow.**—*Trans. Brit. Mycol. Soc.*, xiii, 3–4, pp. 286–304, 4 pl., 1928.

This is a full account of the author's investigation of the *Physalospora* disease of basket willows previously recorded by him in Somerset [*R.A.M.*, vi, p. 529]. The varieties most commonly attacked are *Salix alba* vars. *vitellina* and *cardinalis*, *S. americana*, and certain ornamental kinds. The chief symptoms are the blackening of the leaves, which eventually droop, become shrivelled and dry, but may remain attached to the stem; the formation of slight lesions or definite, deep-seated cankers on the rods; and a die-back of the rods due to infection at the tip or a short distance from it

and subsequent growth of the fungus downwards. No fructifications have been seen on the leaves, but the stem lesions usually bear both perithecia and acervuli of the *Gloeosporium* type, the genetic connexion between which was proved in cultures of the organism. The acervuli are erumpent, 0·3 to 0·7 mm. in diameter, sometimes confluent, and often arranged concentrically. The conidia are hyaline or with a faint greenish tinge (pale pink to colourless in mass), ellipsoidal to ovate or cylindrical, straight or slightly curved, and measure 12·5 to 21·5 by 4 to 7 μ (average 17·5 by 6·5 μ); they are borne on short, flexuous, hyaline, usually one-septate conidiophores, 25 to 35 by 3·5 to 5 μ in diameter. The perithecia appear later, and are gregarious, globose to flask-shaped, with a short neck, and 140 to 200 μ in diameter. They contain fasciculate, club-shaped asci, 65 to 70 (occasionally up to 86) by 10 to 11 μ, together with slender, filiform paraphyses, 1·5 to 2 μ in diameter. The ascospores are one-celled, hyaline, oblong to ellipsoidal, sometimes slightly curved, and 14 to 17 by 5 to 6 μ in diameter. The organism agrees closely in its morphological and cultural characters [which are described in detail], apart from slight differences, with Fukushi's diagnosis [which is reproduced] of *Physalospora miyabeana*, and this name is provisionally retained for it, although further work may show it to be more closely related to the genus *Glomerella*.

The pathogenicity of the fungus to a number of species of willow was demonstrated in artificial infection experiments; both the ascospores and conidia germinated with the production of appressoria, and gained entry into the host tissues through the uninjured cuticle of the leaves, after which the fungus progressed downwards into the main stem. Laboratory experiments indicated that the disease might be effectively controlled by spraying the rods during their growth at intervals of about three weeks with a fungicidal mixture, e. g. Bordeaux mixture.

In an addendum, the author states that parallel inoculations on wounded leaves of *S. pentandra* with conidial suspensions of *P. miyabeana* and *Fusicladiam saliciperdum* almost invariably gave positive results with the former and never with the latter. He suggests that *F. saliciperdum*, which is sometimes found on the central portion of the diseased areas but never in the initial stages of attack, is merely a follower of *P. miyabeana* and is not responsible for the disease on the leaves.

WILSON (M.) & WALDIE (J. S. L.). **Notes on new or rare forest fungi.**—*Trans. Brit. Mycol. Soc.*, xiii, 3–4, pp. 151–156, 1 pl., 1928.

Notes are given on the following British fungi, most of which are considered to be saprophytes, though under certain conditions some may become parasitic: *Rhizosphaera pini* on the leaves of *Abies grandis*, *R. kalkhoffii* [*R.A.M.*, v, p. 636] on the leaves of *Picea pungens* var. *argentea*, *Adelopus balsamicola* on dead leaves of *Abies pectinata* and on leaves of *Pseudotsuga taxifolia*, *Phaeocryptopus abietis* on the leaves of *Pinus armandi* and *Abies faxoniana* (from China), and *Toxosporium camptospermum* and *Menoidea abietis* on leaves of *A. pectinata*.

SIBILIA [C.]. **Die Bekämpfung von Bodenpilzen in Koniferen-Baumschulen.** [The control of soil fungi in conifer nurseries.] —*Nachricht. über Schädlingsbekämpf.*, iii, 4, pp. 109–112, 1928.

Conifers in Italian nurseries are stated to be very liable to infection by the soil fungi, *Pythium de Baryanum*, *Phytophthora omnivora* [cf. *R.A.M.*, vi, p. 326], *Pestalozzia hartigii*, and *Fusarium* spp. [ibid., vi, p. 7]. In an experiment on the control of these organisms on *Pinus laricio* excellent results were given by two applications to the soil, at an interval of ten days, of 0·3 per cent. uspulun. Copper sulphate (0·5 per cent.) was also effective [loc. cit.], but uspulun possesses the dual advantage of greater toxicity to the fungi and of being harmless to the seedlings, so that the concentration can be increased at discretion. Full directions are given for the application of this method of treatment from the time of sowing onwards.

SCHEFFER (T. C.). **Steam sterilization of coniferous seed-beds.**—Abs. in *Phytopath.*, xviii, 11, p. 952, 1928.

Very promising results have been obtained by low pressure steam sterilization, applied by the inverted pan method [*R.A.M.*, vii, p. 335], of Douglas fir [*Pseudotsuga taxifolia*], Sitka spruce [*Picea sitchensis*], and western yellow pine [*Pinus ponderosa*] seed-beds [cf. ibid., vi, pp. 450, 452]. One- and two-hour steaming periods were used, but the results indicate that a shorter time would prove equally effective. The damping-off organisms involved were apparently *Fusarium* sp. and *Phoma* sp.

MCCALLUM (A. W.). **Studies in forest pathology. I. Decay in Balsam Fir (Abies balsamea Mill.).**—*Canada Dept. of Agric. Bull.* 104, N.S., 25 pp., 7 pl., 1 graph, 1928.

This is a detailed report of the author's investigation made in two areas (one north and one south of the St. Lawrence river) of the principal rots of balsam fir (*Abies balsamea*) recorded in the province of Quebec, namely, red heart rot (*Stereum sanguinolentum*), feather butt rot believed to be caused by *Poria subacida*, and the butt rot caused by *Polyporus balsameus* [*R.A.M.*, vi, p. 265].

The most serious of these decays is red heart rot, both owing to its wide distribution, which is co-extensive with that of balsam fir, and to the amount of damage done by it to the timber. It was usually found confined to the upper part of the trunk, extending upward from about the end of the first log, but occasionally it may involve the entire trunk to ground level. The affected wood is firm, water soaked, and of a reddish-brown colour. A prominent feature of this rot, in transverse sections, is the presence of rays, up to two inches in length and half an inch in width, which extend from the main body of rotted wood into the sound, light coloured tissues. In most cases, however, the decay occurs as a solid, circular mass, or it may be present in irregular patches. In incipient stages, white mycelial sheets are often found in the affected

wood, and these persist until the later stages, when the wood becomes light brown in colour, light in weight, dry, and friable.

In feather butt rot, the wood is at first yellowish-buff in colour, becoming lighter as the decay develops. Minute, longitudinal holes in concentric rings soon appear, causing the annual rings to separate. In later stages, small, black spots are usually found in the wood. In extreme cases, the centre of the stem becomes hollow and the surrounding wood is reduced to a mass of water-soaked shreds with a feathery appearance. In this stage dense layers of white mycelium are usually found lining the irregular cavities in the trunk. Although for the most part confined to the roots, stump, and lower end of the first log, this rot may occasionally extend far up the trees.

In the early stages of the second type of butt rot the wood becomes light brown in colour, dry, and light in weight. Later the wood darkens and cracks into irregular cubical blocks, when it can be easily crumbled to powder. In advanced decay hin, white mycelial sheets appear between the blocks. This rot rarely advances more than a few feet from ground level, and does not usually cause much direct loss, but like the preceding it renders the trees more susceptible to damage by wind.

Red heart rot enters the trees chiefly through dead branch stumps, while both butt rots gain entrance mainly through the roots.

A detailed description is given of the methods employed to ascertain the relation of decay to the rate of growth of the trees, and the age at which decay becomes of economic importance. One of the first steps was to calculate the total volume and the merchantable volume of timber in the trees at different ages of growth (from 37 to 190 years). A curve was then drawn by plotting the total volume of each tree against the age, for the purpose of comparing the total volume of individual trees with that of a tree of the same age as read from the curve, and the relation thus obtained was used instead of the usual one of height growth in classifying the trees as dominant and suppressed, according to whether the volumes were greater or less than the average for the same age. It is pointed out that the indications are that, in the two areas studied, balsam firs as a class appear to be suppressed compared with those of New York State, a fact which may serve to explain that, contrary to expectations, cull due to decay was found to be higher in the dominant than in the suppressed type of trees, the actual figures being 20·9 and 11·7 per cent. in the former as against 16·5 and 10·6 per cent. in the latter in the two areas. A very definite relation was found to exist between cull due to decay and age. On the Shipshaw River (in the northern area), it steadily rose from age class to age class, reaching 18 per cent. of the merchantable volume in the 91 to 100 years class. On Lake Metis (the southern area) serious damage was only found in trees over 100 years old, and the amount of cull was much lower throughout than in the other region, this being due to the fact that *Stereum sanguinolentum* was far more abundant in the latter than on Lake Metis. Similar relations were also found between the amount of cull and the diameter of the trees at breast height.

HUBERT (E. E.). **Red-ray rot in Pinus ponderosa.**—*Northwest Science*, ii, 2, pp. 45–47, 1928.

In this paper a description is given of the symptoms of red ray rot (*Polyporus anceps*) [*R.A.M.*, ii, p. 482] of western yellow pine (*Pinus ponderosa*), which is widely distributed throughout the yellow pine regions in the north-western United States. It is often confused with red ring rot (*Trametes pini*), but differs from it in the following respects. The conk [sporophore] is white, small, annual, and is rarely found on the living tree. In the early stage the wood is reddish to reddish-brown, while in the late stage it becomes soft and useless, and the pockets show blunt or square ends. At the end of the cut log the rotted area is frequently star-shaped, except when the rot completely fills the heartwood area. Red ray rot is a typical trunk rot, extending 10 to 20 feet or more up the trunk, but in some regions it appears as a top rot reaching 15 to 40 feet downward from the lower end of the dead top. The disease is also stated to be common on Engelmann spruce [*Picea engelmanni*], lodgepole pine [*Pinus murrayana*], western red cedar [*Thuja plicata*], Douglas fir [*Pseudotsuga taxifolia*], and Canadian jackpine [*Pinus banksiana*].

WILSON (M.) & HAHN (G. G.). **The identity of Phoma pitya Sacc., Phoma abietina Hart. and their relation to Phomopsis pseudotsugae Wilson.**—*Trans. Brit. Mycol. Soc.*, xiii, 3–4, pp. 261–278, 4 pl., 1928.

The authors give an exhaustive review of the confusion which has hitherto existed concerning the identity of *Phoma pitya* Sacc. (corrected spelling of Saccardo's *P. pithya*) and *P. abietina* Hartig [*R.A.M.*, v, p. 259], and which led them to undertake a critical study of both species, together with *Phomopsis pseudotsugae* [loc. cit.]. An examination of the type specimen of *Phoma pitya* showed it to be a species of *Sclerophoma* which, in view of the existence of *S. pitya* (Thüm.) v. Höhn., is renamed *S. magnusiana*, a full English diagnosis being given. Specimens under the name *P. pitya* in Rostrup's herbarium included a number of species of *Sclerophoma* but not *S. magnusiana*.

Examination of German herbarium material of *Phoma abietina* Hart. showed that this species belongs to the genus *Phomopsis*, and it is accordingly renamed *P. abietina*, a diagnosis in English being appended. The stromata are thickly scattered, subconical or subglobular, with a flattened base, and immersed in the periderm with only the apex protruding; the pycnidia are black, unilocular, 120 to 300 by 60 to 180 μ, or multilocular, 360 to 500 by 240 to 380 μ; the wall is very thin below but becomes much thicker above; the spores are hyaline, unicellular, spindle-shaped with acute ends, 9·5 to 15 by 4 to 6 μ, and extruded in a whitish tendril or drop; B spores were not observed. Fresh French material of *Fusicoccum abietinum* proved to be the same fungus. This species is distinct morphologically and physiologically from *P. pseudotsugae*, which has been shown to be a true parasite of the Douglas fir (*Pseudotsuga douglasii*) [*P. taxifolia*] and other conifers in Great Britain, Denmark [ibid., vi, p. 446], Holland [ibid., vii, p. 426], and is now recorded for Norway and Sweden. *P. abietina* only occurs on

Abies spp., on which it causes a canker constriction of the smaller branches, and has not yet been recorded in Great Britain. *S. magnusiana* is very probably only a saprophyte.

A bibliography of 64 titles is appended.

HAHN (G. G.). **Phomopsis conorum (Sacc.) Died.—an old fungus of the Douglas Fir and other conifers.**—*Trans. Brit. Mycol. Soc.*, xiii, 3–4, pp. 278–286, 2 pl., 1928.

This is stated to be the first record from Great Britain of *Phomopsis conorum*, which was found to occur frequently in Scotland and Wales on dead and dying shoots of the Douglas fir (*Pseudotsuga douglasii*) [*P. taxifolia*], particularly upon young nursery plants. Fresh collections of the fungus on the same host are reported from Holland and Denmark, while other hosts for the organism are species of *Picea*, *Pinus*, and *Abies*. Among the herbarium specimens of *Phoma pitya* [see preceding abstract] on various conifers in Rostrup's herbarium examined during the investigation, a *Phomopsis* species was discovered which bears a strong morphological resemblance to *P. conorum*. The latter fungus [a full description of which is given] differs from *P. pseudotsugae* both morphologically and physiologically, and also in cultural details, though without critical examination the two diseases may be easily confused. The pycnidia are scattered or aggregate, ectostromatic, becoming partially erumpent with the rupture of the epidermis, black, cone-shaped, lenticular, or globular, with the cavity tending to be divided by pseudopartitions. The A spores are unicellular, hyaline, mostly spindle-shaped with acute or sub-acute ends, 6·5 to 13 by 2·5 to 4 μ, while the B spores are hyaline, continuous, filamentous, curved, and 10 to 32 by 1 μ. The conidiophores are flexuous, with acute tips, occasionally branched, and 8 to 20 μ long. Preliminary inoculation experiments tend to show that it is a saprophyte, but observations in Great Britain lead to the belief that under certain conditions it might become weakly parasitic, as it was apparently frequently associated with frost injury among young seedlings of the Douglas fir.

ALCOCK (Mrs. N. L.). **Keithia thujina, Durand: a disease of nursery seedlings of Thuja plicata.**—*Scottish Forestry Journ.*, xlii, 2, pp. 77–79, 3 figs., 1928.

Four- to five-year-old *Thuja plicata* seedlings are stated to be commonly attacked in England, Scotland, and Ireland by the troublesome leaf blight due to *Keithia thujina* [*R.A.M.*, ii, p. 348], which may cause the death of a high proportion of the stand. In severe cases the young trees present a scorched appearance, the twigs being covered with small, round, dark brown spots or cushions. The raised epidermis often shows as a small, round, lid-like scale over the fruiting bodies. The lid falls off and subsequently the spores are shed, leaving a circular depression in the leaf. At a later stage the leaves turn whitish-grey and they show numerous small holes in advanced stages.

The asci of *K. thujina* contain only two spores, which are spotted and roughened, nearly black at maturity, and measure 15

to 24 μ in length; they are bicellular but appear unicellular owing to the smallness and indistinctness of the upper cell. Paraphyses are present. Infection of new plants takes place from fragments of leaf and twig which fall to the ground, and may be spread by the admixture of diseased material with the seed. The disease may be controlled by spraying with 4–4–40 Bordeaux mixture.

WATSON (H.). **Notes on attack by Rhizoctonia crocorum on Sitka Spruce (Picea sitchensis).**—*Scottish Forestry Journ.*, xlii, 2, pp. 58-61, 1928.

Two areas of Sitka spruce (*Picea sitchensis*) growing on moderately acid sandy loam soil in Inverness-shire were found, in April, 1928, to be attacked by *Helicobasidium purpureum*, the perfect stage of *Rhizoctonia crocorum* [*R.A.M.*, vi, p. 756], some 8,000 seedlings being affected. The violet-coloured, velvety fructifications of the fungus enveloped the collar, and in many cases encircled some of the small lower branches and spread over the surrounding soil. The roots were badly rotted and showed a marked purplish-brown discoloration; they were also covered with the small black 'infection cushions' typical of *R. crocorum*. The most prevalent weeds in the affected area were sheep's sorrel (*Rumex acetosella*) and white clover (*Trifolium repens*), the former being severely attacked by *H. purpureum*. Very severe frosts occurred during the previous December, and it is thought that this may have been a predisposing factor.

BUCHWALD (N. F.). **De danske Arter af Slægten Merulius (Hall.) Fr. med en særlig Omtale af Gruppen Coniophori Fr.** [The Danish species of the genus *Merulius* (Hall.) Fr. with a special discussion of the group *Coniophori* Fr.]—*Dansk Bot. Arkiv*, v, 21, 47 pp., 6 figs., 1928. [English summary.]

This is a full survey, accompanied by tables, of the history, distribution, and taxonomy of the genus *Merulius*, with special reference to the occurrence in Denmark of species belonging to the section *Coniophori*.

M. lacrymans [*R.A.M.*, viii, p. 79] has only been found insid buildings in Denmark. The fungus on *Castanea vesca* described by Rostrup as *M. lacrymans* is thought to have been *M. himantioides*. It is further considered probable that the reports of 'wild forms' of *M. lacrymans* in other countries [cf. ibid., vi, p. 9] are largely due to confusion with *M. himantioides*. *M. silvester* for instance, as described by Falck [ibid., vii, p. 292], is stated to be very close to, and probably identical with, *M. himantioides*.

M. pinastri (with which *M. minor* and *M. hydnoides* are considered synonymous) is occasionally found both in houses and out of doors on wood of *Pinus sylvestris* and other species of *Pinus*, *Picea abies*, *Cedrus* sp., and various hardwoods, e. g., alder, chestnut, ash, apple, and poplar.

M. sclerotiorum, hitherto apparently known only in Germany [but see ibid., viii, p. 3], has been found indoors in two localities in Denmark. Where the sclerotia are absent this species may easily be confused with *M. lacrymans*.

BAVENDAMM (W.). **Neue Untersuchungen über die Lebensbedingungen holzzerstörender Pilze. Ein Beitrag zur Frage der Krankheitsempfänglichkeit unserer Holzpflanzen. II. Mitteilung: Gerbstoffversuche.** [New investigations of the conditions governing the existence of wood-destroying fungi. A contribution to the problem of the susceptibility to disease of our woody plants. Note II: tannin experiments.]—*Centralbl. für Bakt.*, Ab. 2, lxxvi, 8–14, pp. 172–227, 3 pl., 1928.

Continuing his investigations on the conditions governing the existence of wood-destroying fungi [*R.A.M.*, viii, p. 210], the author carried out a series of experiments [the technique of which is described and the results discussed and tabulated] to define the function of tannin in the nutrition of these organisms. The fungi tested were *Merulius lacrymans*, *Coniophora cerebella*, *Lenzites sepiaria*, *Stereum frustulosum*, *Trametes radiciperda* [*Fomes annosus*], *T. pini*, *Panus stipticus*, *S. purpureum*, *Polyporus* [*Daedalea*] *borealis*, and *P. suaveolens*.

Tannin was found to act as a strong deterrent to the growth of all the fungi tested, the addition of 2 per cent. to one of the standard media completely inhibiting development in most cases. The xylophagous fungi in general can, however, tolerate fairly strong concentrations of natural tanning extracts derived from the wood or bark of trees, as distinct from commercial tannin, while the growth of some, especially the parasitic heart-wood organisms, is actually favoured by the presence of these substances. Of the saprophytes, *M. lacrymans*, unlike *C. cerebella*, is particularly sensitive to the effect of tanning extracts.

The minute quantities of sugar and glucosides present normally in these tanning extracts were found to exercise no appreciable influence on the growth of the fungi, so it would seem that the favourable effects are due to the splitting off of sugars from the tanning extract itself by means of enzymes secreted by the fungi.

The presence of tannin in trees is not, therefore, as frequently alleged, a universal specific against fungi, but rather tends in many cases to promote their development.

Certain xylophagous fungi, growing on agar plates with tannin, formed through the action of oxydases more or less distinct dark brown haloes round their colonies. In general, this is a characteristic of the lignin-destroying organisms, which is not shared by those disintegrating cellulose. Attention is drawn to the parallels existing between lignin- and tannin-disintegration. This brown discoloration is stated to constitute a simple method for the detection of oxydases, and may be used as a diagnostic character. The significance of the brown discoloration in the type of rot and in humus formation is also discussed.

A five-page bibliography is appended.

HOTSON (J. W.). **Armillaria mellea in mines and wells.**—Abs. in *Phytopath.*, xviii, 11, p. 948, 1928.

Armillaria mellea has been found in profusion on wooden supports in several coal mines in Washington, and also on wooden

curbings in wells. Rhizomorphs developed in abundance, hanging down in festoons from the timbers in the mines, and floating on the water in the wells.

Bartlett (A. W.). **Olpidium radicicolum de Wildeman and the 'hybridisation nodules' of Swedes.**—*Trans. Brit. Mycol. Soc.*, xiii, 3–4, pp. 221–238, 2 pl., 1928.

This is a detailed account of the author's investigation at Newcastle-upon-Tyne of the so-called 'hybridisation nodules' which are frequently met with on the roots of swedes, and which have also been observed occasionally on the roots of turnip, rape, kohlrabi, cabbage, cauliflower, and Brussels sprouts. On swedes the nodules, which are attached by a narrow base to the underground portion of the root, vary considerably in size (from that of a pea to over 2 cm. in diameter) and in shape (from more or less spherical to very irregular), and have an uneven and wrinkled or lobed surface. Their colour is yellowish-white, but on growing older, and when the roots are exposed to light, they show a tendency to become green. A peculiar feature of the condition is the production of blanched leafy shoots that arise underground either from the nodules themselves or from between the latter and the roots bearing them. The nodules have vascular bundles, and, therefore, appear to be modified lateral roots, a view which is supported by the fact that they occupy the position of lateral roots and that small rootlets are occasionally found with a small rounded swelling at the base.

No trace of any parasite could be found in the tissues of the nodules, but temporary and resting sporangia of a species of *Olpidium* were usually abundant in the rootlets arising in large numbers from the bases of the nodules. They occurred most abundantly in the piliferous layer and in the outermost cells of the cortex of the finer roots, occasionally in the root hairs. For these reasons it is believed that during the passage of a lateral root primordium through the cortex of the root, the cells of its growing point are stimulated by the action of the fungus, resulting in the formation of the nodules. The temporary and resting sporangia agree entirely in their morphology [a full description of which is given] with de Wildeman's *Olpidium radicicolum* and *Asterocystis radicis*, respectively, and the fact that both have been repeatedly observed by the author in the same root, or even in the same host cell, leads him to consider that both belong to the same species, which, for reasons of priority, should be known as *O. radicicolum* [cf. *R.A.M.*, vii, p. 202]. He is also of opinion that the name *Olpidiaster radicis* (de Wild.) Pasch., suggested for *A. radicis* on the ground that the generic name *Asterocystis* had already been used for a genus of algae, is not valid for the same reasons.

Infection experiments in pots indicated that under certain conditions *O. radicicolum* may be very injurious to seedlings of swedes and turnips, and to a lesser degree to seedlings of cabbage; garden cress [*Lepidium sativum*] and white mustard [*Brassica alba*], on the other hand, suffered but little, if at all, from its attacks. This suggests that the fungus may be responsible for the gaps in the rows or for partial failure often experienced in field sowings of

turnips and swedes during abnormally wet seasons. In plot experiments, a number of swedes grown in artificially infected soil produced nodules, while in the control plots no nodules were formed, with the exception of a few plants in one case, in which it was found that the soil had been accidentally contaminated with the organism. Turnips grown in infected soil very rarely produced nodules, and none were found in cabbages.

As far as the author is aware, this is the first record in Great Britain of *O. radicicolum* and of *O. brassicae*, which he also encountered occasionally in the course of his work.

CARSNER (E.) & LACKEY (C. F.). **Further studies on attenuation of the virus of Sugar Beet curly-top.**—Abs. in *Phytopath.*, xviii, 11, p. 951, 1928.

Sugar beets resistant to curly top were infected by viruliferous leafhoppers [*Eutettix tenella*] and the virus then transferred from the diseased plants to healthy susceptible individuals. It was shown that, under certain as yet undefined conditions, the passage of the virus through resistant beets results in a marked attenuation of the former, sometimes equal to that after passage through *Chenopodium murale* [*R.A.M.*, v, p. 339]. The variation in degree of attenuation seems to be directly correlated with the severity of the symptoms on the infected resistant plants used as the source of the virus. It appears that the virulence of the attenuated virus cannot be restored either by prolonged incubation in, or repeated passage through, susceptible plants.

SCHMIDT. **Das Beizen des Zuckerrübensamens.** [The disinfection of Sugar Beet seed.]—*Die Deutsche Zuckerind.*, liii, 15, pp. 401–403, 1928.

Full details are given of the writer's observations and experiments in the control of beet root rot (*Phoma betae*, *Pythium de Baryanum*, and *Aphanomyces levis*) by means of seed-cluster disinfection. The conclusion is reached that this process is efficacious only against *Phoma betae*: it cannot protect the seedlings against the attacks of the other two organisms which occur in the soil [see next abstract].

Tests of various [named] liquid and dust disinfectants during the three years 1925 to 1927 showed that none effected a consistent reduction in the incidence of the disease.

P. betae was frequently observed to develop on dusted seed-clusters removed from the soil and placed in nutrient media, whereas the fungus generally failed to grow on the seed-clusters properly treated with a liquid fungicide.

STEHLÍK (V.) & NEUWIRTH (F.). **Soll Rübensamen stimuliert und gegen Wurzelbrand gebeizt werden? II.** [Should Beet seed be stimulated and disinfected against root rot? II.]—*Zeitschr. für Zuckerind.*, Prague, liii, 17–18, pp. 181–196, 1929.

Further investigations and experiments [the results of which are fully discussed and tabulated] have confirmed the writers in their previous conclusion [*R.A.M.*, vi, p. 649 and preceding abstract]

that nothing is to be gained by the disinfection of beet seed against root rot (*Phoma betae, Pythium* [*de Baryanum*], &c.). Among the preparations proving useless for this purpose were betanal (dust and liquid), germisan (dust and liquid), abavit B dust, tillantin C dust, and liquid ostan.

TOMPKINS (C. M.) & NUCKOLS (S. B.). **Development of storage diseases in Sugar Beets resulting from hook injury.**—*Phytopath.*, xviii, 11, pp. 939–941, 2 figs., 1928.

Attention is drawn to the risk of the development of storage diseases in sugar beets as a result of injuries inflicted by the hooked knife commonly used for topping in the Pacific Slope States. Many tons of beets are stored for periods of varying length (average 40 days), and it is estimated that losses of 15 to 25 per cent. may be incurred through rotting due to injuries sustained in this way. The principal organisms involved are *Phoma betae* and several species of *Fusarium*. It is recommended that the straight beet knife used in Colorado and elsewhere should be substituted for the hooked implement.

PALO (M. A.). **A Fusarium causing bulb rot of Onion in the Philippines.**—*Philipp. Agric.*, xvii, 6, pp. 301–316, 4 pl., 4 figs., 1928.

In December, 1926, the writer inspected a bundle of diseased onions from Batangas Province (Philippine Islands) which were attacked by a *Fusarium* rot. The plants showed a yellow discoloration and die-back of the leaves, accompanied by a semi-watery decay of the bulbs. A similar disease, the loss from which was estimated at 40 to 50 per cent. of the crop, was observed at Los Baños in 1925.

The causal organism was isolated from the infected tissues and inoculated into Singapore Red onions with positive results. It proved to be a variety of *F. zonatum* closely allied to, and probably identical with, *F. zonatum* forma 1 [*R.A.M.*, vi, p. 268], from which it differs mainly in its colour on steamed rice (pale ochraceous salmon instead of cream-white to salmon buff) and in its somewhat higher degree of virulence to unwounded bulbs. The conidia of the Philippine *Fusarium* [the cultural and morphological characters of which are fully described, with an English diagnosis] average 32·3 by 4 μ, as compared with 37·1 by 3·8 μ for *F. zonatum* forma 1 and 38·5 by 3·7 μ for forma 2.

The disease is spread by the removal of infected bulbs from one place to another, as well as by heavy rains, the whirlwinds prevalent in Batangas during March and April, and implements. Probably infection normally occurs through insect injuries in the bulb. The results of a limited field trial [details of which are given] showed that the optimum soil moisture content for the Philippine form of *F. zonatum* lies between 50 and 85 per cent. of the water-holding capacity of the soil, thus approximately coinciding with the optimum conditions for the development of Singapore Red onions. Control measures should be based on sanitary practices, such as crop rotation, bulb selection (which is much neglected), and careful methods of handling in harvesting, curing, and storing.

GOOSSENS (J. A. A. M. H.). **Onderzoek over de door Phoma apiicola Klebahn veroorzaakte schurftziekte van de Knolselderij en over synergetische vormen en locale rassen van deze zwam.** [Investigation of the scab disease of Celeriac caused by *Phoma apiicola* Klebahn and of the synergetic forms and local strains of this fungus.]—*Tijdschr. over Plantenziekten*, xxxiv, 11, pp. 271–316; 12, pp. 317–348, 3 pl., 2 graphs, 1928. [English summary.]

This is a comprehensive account of the writer's investigations of *Phoma apiicola*, which is stated to cause heavy losses in the extensive Dutch celeriac crops [cf. *R.A.M.*, vii, p. 421].

Slightly diseased rootstocks are covered with shallow, rusty spots, the tissue underlying which shows a dark, more or less sharply defined discoloration. Necrotic yellow spots also occur on the slender roots. In cases of severe infection the rootstocks exhibit a wrinkled, scabby surface. Deep vertical fissures occur on the collar, and all the slender roots of the plant are entirely rotted. This is the form of the disease described by Bennett (*Michigan Agric. Exper. Stat. Tech. Bull.* 53, 1921) as *Phoma* root rot. Infection of the lamina and stalks by *P. apiicola* is unknown in Holland, but the enlarged base of the petiole is very liable to attack.

P. apiicola was only once observed on any of the numerous seed samples examined, and it is believed that the fungus is very rarely transmitted through this source. In addition, a second, undetermined species of *Phoma* with larger spores and not pathogenic to this host was isolated from celeriac seed.

Two strains of *P. apiicola* were obtained in pure culture from the rootstocks and petiole bases of celeriac grown on sandy soil near Venlo and on clay soil round Maastricht, respectively. Cultures from both strains produced pycnidia on sterilized celeriac rootstocks and crushed petioles. On transferring the pycnospores to Coons's liquid medium, it was observed that the Maastricht strain made good growth while that from Venlo failed to develop.

Two types of individuals were obtained from pycnospores transferred from sterilized celeriac rootstocks to agar media, viz., one with copious mycelial production, and the other developing numerous pycnidia. The pycnidia of the new form (herein referred to as *P. apiicola microforma*) were smaller than those of the original strain (*P. apiicola macroforma*), namely, 70 to 185 compared with 175 to 420 μ. The length of the pycnospores was approximately equal in both forms—3·37 to 4·87 μ for the macro- and 2·99 to 4·87 μ for the micro-form. These two different forms were produced by both the Venlo and Maastricht strains.

When the micro-form is transferred at room temperature to sterilized petioles, pycnidia soon develop and produce pycnospores which yield only the micro-form on agar media, thereby showing the constancy of the variant under these conditions. However, when the cultures are kept at 0° to 5° C., pycnidial formation is slow, and the resulting pycnospores produce individuals of both types, denoting partial reversion to the original macro-form.

When grown together, e. g., on celery agar, the micro- and macro-forms produce numerous pale yellow, globular pycnidia, with black

ostioles, at the line of contact of their mycelia. These so-called 'conjunct' pycnidia measure 200 to 250 μ in diameter and therefore correspond approximately with those of the macro-form and with the bodies observed on diseased plants in nature. This phenomenon was not observed to result from contact between mycelia of the same type. The production of conjunct pycnidia is believed to be a function of the macro-form, the stimulus to which is given by the micro-form. In the absence of the latter there was no such intensity of pycnidial production on agar cultures. When spore suspensions from single conjunct pycnidia were sown on celery agar, colonies of both the micro- and macro-forms developed (the latter in excess), and in their turn yielded fresh conjunct pycnidia. The conjunct pycnidia thus evidently contain the spores of both forms. The conjunct pycnidia are not thought to result from heterothallism but are explicable on the following basis. Hyphae of both forms of the fungus participate in the structure of the conjunct pycnidia, but this process is not accompanied by fusion of cell nuclei. Hence the hyphae of each form retain their individual characters and in their turn produce the spores of each in one and the same pycnidium. If this hypothesis be correct, the conjunct pycnidia must be regarded as chimeras, in which the cells of the component parts are intermingled instead of being distributed in a sectorial or periclinal arrangement. This process, to which the term 'synergetic' is applied, is believed to be the first instance on record of pycnidial formation in such a manner.

The results of inoculation experiments [which are fully described] showed that the micro- and macro-forms of both the local strains are capable of attacking the roots and bases of the petioles of celeriac. Normally neither strain infects the leaf blades, but under humid conditions the micro-forms were found to attack these organs severely, while the macro-forms caused little or no damage. This suggests the possibility that the micro-form may be identical with *Phyllosticta apii*. Of the twenty varieties of celeriac tested for their reaction to *Phoma apiicola*, only two, namely, the large, rapidly growing Riesen Alabaster and Venlo celeriac, showed any degree of resistance.

The macro-form of *P. apiicola* was found to lose its virulence and capacity for pycnidial formation when grown continuously from mycelium on agar media, but this degeneration may be avoided by occasional transference to the living plant or to cultures of the micro-form, followed by reculturing from the spores of the resulting conjunct pycnidia.

JAGGER (I. C.). **The brown blight disease of Lettuce.**—Abs. in *Phytopath.*, xviii, 11, pp. 949–950, 1928.

For the past twelve years the lettuce crops in the Imperial Valley of California have suffered increasing damage from a soil-borne disease known as brown blight, which has recently been found in other parts of the State and in Arizona. Plants are attacked at all stages. Young plants become yellowish, mottled, much stunted, and gradually die, while older ones also develop conspicuous dead brown streaks and blotches on the leaves. Crop

rotation has not given any appreciable degree of control. The fungus *Asterocystis radicis* [see above, p. 282] has been found fairly constantly in diseased roots, but no definite proof of its implication in the disturbance is forthcoming. Highly resistant strains of the New York Iceberg variety have been developed for extensive cultivation in the Imperial Valley in place of the susceptible Imperial strains.

MANUEL (H. L.). **Experiments in the control of black spot of the Vine.**—*Agric. Gaz. New South Wales*, xxxix, 11, pp. 849–853, 1928.

Sultana grape vines in Australia are stated to be very susceptible to anthracnose (*Gloeosporium ampelophagum*), though the Labrusca types apparently are not.

In experiments on control [details of which are given] the best result (8 per cent. of the vines but no bunches affected, as compared with 65 and 47 per cent., respectively, in the untreated plot) was given by swabbing the vines, when the buds were just swelling, with a solution of 100 lb. iron sulphate and 10 pints sulphuric acid in 20 galls. water. The omission of the iron sulphate reduced the efficacy of the solution, while the plots sprayed with lime-sulphur and with winter strength Bordeaux mixture on the same date had 25 and 8, and 25 and 3 per cent. vines and bunches affected, respectively.

When the disease has been severe during the previous season two swabbings are advised, one about three weeks before, and the other just before, the buds open, while Bordeaux mixture should also be applied during the growing period.

Brief directions are given for the preparation and application of the swabs.

MANZONI (L.) & PASINETTI (L.). **Assimilazione carbonica e anticrittogamici.** [Carbon assimilation and fungicides.]—Reprinted from *Annuario Staz. Sper. di Vitic. di Conegliano*, iii, *1927–1928*, 49 pp., 1 diag., 1928.

Experiments [which are described and the results tabulated and discussed] showed that while repeated applications of Bordeaux mixture to vines did not appreciably reduce the assimilation of carbon by the leaves when the latter were exposed to direct sunlight, they did so to a marked extent when the leaves were in a diffuse light, and this effect increased with the opacity of the spray mixture and the thickness of the deposit left on the leaves.

As under north Italian conditions excessive spraying is sometimes practised, the authors recommend that applications of Bordeaux mixture should be as few, dilute, and sparing as is consistent with their object; the mixture used should not contain an excess of lime; and, if possible, more transparent fluids should be used. The prevalent view that spraying mixtures, to be effective, should be almost opaque is stated to have no foundation in fact and is strongly deprecated.

Krankheiten und Beschädigungen der Kulturpflanzen im Jahre 1927. [Diseases and pests of cultivated plants in the year 1927.]—*Mitt. Biol. Reichsanst. für Land- und Forstwirtsch.*, 37, 212 pp., 2 graphs, 20 maps, 1928.

This report is prepared on similar lines to those of previous years [*R.A.M.*, vii, p. 8], Dr. H. Pape being mainly responsible for the sections on fungous and bacterial diseases, while Dr. O. Schlumberger supplies the information on potato wart (*Synchytrium endobioticum*). Only a few of the many interesting references can be mentioned here.

Loose smut of barley (*Ustilago nuda*) occurred in almost all parts of the country with exceptional severity, and stripe disease (*Helminthosporium gramineum*) was reported from Lübeck as present to an unprecedented extent. The foot rots of cereals (*Leptosphaeria herpotrichoides, Ophiobolus herpotrichus, Fusarium* spp., etc.), caused heavy losses [ibid., vii, p. 626]. *Typhula graminum* was responsible for a certain amount of winter injury to barley, oats, and rye. Maize smut (*Ustilago maydis*) [*U. zeae*] was reported from Brandenburg and Silesia.

Good control of the reclamation disease on rye and oats was obtained by the application to the soil of copper sulphate and potassium salts [ibid., vii, p. 396 *et passim*]. Grey speck of oats was observed to be on the increase in Westphalia on light, humus-containing soils as a result of over-liming.

Bacterial ring disease of potatoes [*Bacterium sepedonicum*: ibid., vii, p. 50] occurred in a very severe form in Hanover, especially on the Eigenheimer variety.

Clover anthracnose (*Gloeosporium caulivorum*) [*Kabatiella caulivora* : ibid., vii, p. 641] assumed serious dimensions in Hesse-Nassau (where the red Siebenburger variety was very severely attacked), Westphalia, and the Rhine Provinces.

Tomato canker (*Didymella lycopersici*) occurred in a most destructive form and caused exceptionally heavy losses in the Rhine Provinces.

Mycogone perniciosa and the so-called plaster-of-Paris disease (? *Verticilliopsis infestans* Cost.) [ibid., vii, p. 488] did much damage in mushroom beds near Hamburg.

The European gooseberry mildew (*Microsphaera grossulariae*) was much in evidence at Geisenheim (Hesse-Nassau). Cultivated blackberries in Pomerania were attacked by stem spot disease (*Rhabdospora ramealis*). Currants and gooseberries in Lübeck are reported to be gradually dying out as a result of infection by *Verticillium albo-atrum*. Sweet cherries were heavily attacked by *Cercospora cerasella* in Baden.

Serious damage was caused to vines in the Linz district (Rhine) by root rot (*Dematophora* [*Rosellinia*] *necatrix*) [ibid., viii, p. 86]. Both downy and true mildew (*Peronospora* [*Plasmopora*] *viticola* and *Oidium tuckeri* [*Uncinula necator*]) occurred in a virulent form.

Leaf fall of pines (*Lophodermium pinastri*) caused heavy damage in various districts of north Germany. *Phoma* [*Phomopsis*] *abietina* [see above, p. 278] severely injured 60- to 80-year-old spruce stands in Württemberg. Willows (*Salix americana*) were severely

infected by *Gloeosporium salicis* and limes by *G.* [*Gnomonia*] *tiliae*. A serious disease of young mulberry trees in Pomerania was attributed to *Fusarium urticearum* (Cda) Sacc.

Brief notes are also given on a number of diseases of ornamental plants.

BAUDYŠ (E.). **Fytopathologické poznámky III.** [Phytopathological notes III.]—*Ochrana Rostlin*, vii, 6, pp. 118–128, 7 figs., 1927. [French summary. Received March, 1929.]

Grafts of two pippin varieties of apples in a locality in Czecho-Slovakia showed in 1927 a curious malformation strongly resembling witches' broom. Examination of diseased specimens showed the malformation to be caused by *Podosphaera leucotricha*, presumably carried as mycelium in the grafts. The young leaves and shoots were killed by the parasite as soon as they emerged, this stimulating the development of dormant buds, which also succumbed in the same way. A contributory factor to the phenomenon was the exceptionally cold weather in the spring of that year, severe morning frosts occurring as late as in the middle of May.

Another marked feature of the year was the great prevalence of *Botrytis cinerea* in various greenhouse cultures, in vegetable stores, and in some field crops. Among the latter, the greatest damage was done to lentils and peas, which in certain localities had to be ploughed under. Grapes and melons also suffered severely from attacks of the fungus. Good control in greenhouses was obtained by spraying the plants with 1·5 per cent. lime-sulphur solution or, better still, with a 1 per cent. solution of sulikol; the latter is preferable to solbar owing to its greater adhesiveness.

BAUDYŠ (E.). **Fytopathologické poznámky IV.** [Phytopathological notes IV.]—*Ochrana Rostlin*, viii, 6, pp. 151–162, 10 figs., 1928. [German summary.]

In this paper brief notes are given on certain insect pests and fungal diseases which were observed in 1928 in Moravia. *Sclerotium rhizodes* [*Typhula graminum*: *R.A.M.*, viii, p. 21] appears to be spreading on meadow grasses which, in the past year, suffered considerably from its attacks. On *Phalaris arundinacea*, in particular, it caused a pronounced stunting of the plants, the terminal leaves of which dried up and bent inwards. *Dilophospora graminis*, although less widespread, caused appreciable damage to pastures in some localities, where the hay had to be cut down prematurely and immediately removed in order to prevent a further spread of the fungus.

Lime trees suffered locally from severe defoliation due to attacks of *Gloeosporium* (*Gnomonia*) *tiliae* which passed from the leaves on to the flower stalks, killing the latter prematurely. The early defoliation of the trees prevented the normal maturation of the newly formed wood, which suffered severely from winter frosts and was attacked by secondary fungi, e. g., *Nectria cinnabarina* and species of *Cytospora*.

Pseudomonas campestris was fairly prevalent on radishes, causing a blackening of the root tissues. Still more frequently radishes showed brown or brownish-black, depressed spots on their

surface; these were caused by *Peronospora brassicae*, which passed from the leaves to the underground parts of the host. Besides being unsightly, the diseased radishes lost much of their comestible qualities and acquired a bitter taste. The soil of the plots on which outbreaks of the disease have occurred should be disinfected with mercurial preparations, such as germisan or uspulun.

GARBOWSKI (L.). **Choroby roślin uprawnych oraz drzew i krzewów leśnych i parkowych w Wielkopolsce i na Pomorzu w r. 1926 i 1927.** [Diseases of cultivated plants and of ornamental and forest trees and shrubs recorded in 1926 and 1927 in Great Poland and Pomerania.]—*Prace Wydz. Chorob Roślin w Bydgoszczy Państw. Inst. Naukow. Gospod. Wiejsk.* [*Trans. Phytopath. Sect. in Bydgoszcz of the State Inst. of Agric. Sci.*], 7, 55 pp., 4 pl., 15 maps. [Undated, received February, 1929. French summary.]

In this report, compiled on the same lines as the previous ones [*R.A.M.*, v, p. 713], notes are given on the diseases of the main crops and woody plants which were recorded in western Poland in 1926 and 1927. A noticeable feature was the reappearance, after a fairly long period of quiescence, of *Ophiobolus graminis*, which caused a severe foot rot of wheat in several districts. Repeated measurements made by the author gave a range of 97 to 105 by 10·5 to 11·3 μ (in one case 114 by 13 μ) for the asci and of 83 to 90 by 3 to 3·5 μ for the ascospores; the perithecia contained filiform, transversely septate paraphyses, about 5 μ in diameter at the base. The fungus was often found on wheat in association with *Leptosphaeria herpotrichoides*, *Ascochyta graminicola*, *Septoria graminum*, and a *Hendersonia*-like fungus, believed to be probably identical with *Wojnowicia graminis*. *Leptosphaeria tritici* was recorded on wheat (usually in association with *Ascochyta graminicola*), rye, and oats. Rye also suffered from foot rot caused by *L. herpotrichoides*, frequently associated with *Mycosphaerella basicola*, *Calonectria graminicola*, or an undetermined species of *Hendersonia* or *Wojnowicia*. New records for the region surveyed are stated to be *Vermicularia graminella* and *Stemphylium graminis*, both on oats.

Among the numerous notes on diseases of fodder plants and vegetables, the following may be mentioned. The roots of diseased lucerne bore fructifications of *Volutella ciliata* and of a species of *Phoma*; the plants were suffering from an attack of *Sclerotinia trifoliorum*. Two varieties of field peas (Dwarf and Victoria) were severely attacked by *Mycosphaerella pinodes*, which formed perithecia on the stems and leaves of the plants; most of the diseased plants also bore *Ascochyta pisi* on the young pods [cf. ibid., vii, p. 611]. In a garden in Bydgoszcz *Phytophthora infestans* infected eggplants growing in a plot of potatoes heavily infected with late blight, causing a rapid rot of the eggplant fruit.

Sphaerotheca mors-uvae was again very prevalent on gooseberries, many plantations having had to be destroyed in consequence. This is partly attributed to inadequate control measures, as the only fungicide recommended, namely, 0·01 per cent. sodium arsenate solution, is nowhere used. Lilac bushes were attacked by

Pseudomonas syringae, a new record for Poland. In north-eastern Poland seedlings of *Pinus sylvestris* were severely infected by *Melampsora pinitorqua*, chiefly on the apical part of the shoots and at the base of the needles; in 1926 its teleuto stage was found on aspens in several localities. In the same year and in 1927 large numbers of perithecia of *Microsphaera quercina* were found on *Quercus pedunculata* and *Q. sessilis* in west Posnania.

In the 15 maps appended is shown the distribution in the region surveyed of the chief diseases of the main agricultural crops.

IVANOFF (B.). Фитопатологична секция. [Phytopathological section.]—*Rap. Ann. Stat. Agron. de l'État à Sofia (Bulgarie) pour 1926*, pp. 145–174, 1928. [Bulgarian.]

Notes are given on 219 species of parasitic bacteria and fungi recorded up to date in Bulgaria on 68 species of cultivated plants, a host index being appended. This total is made up of 10 species of Schizomycetes, 2 Plasmodiophoraceae, 13 Oomycetes, 15 smuts, 27 rusts, and 6 Hymenomycetes, while the Ascomycetes and Fungi Imperfecti are represented by 60 and 86 species, respectively. Most of the organisms mentioned are well known plant parasites. Of all the diseases listed, the smuts and rusts are stated to be the most widespread and of the greatest economic importance. Considerable damage was done to roses (which are grown extensively for the industrial distillation of attar of roses) by *Phragmidium subcorticium*, which reduced the crop by over one-third. Good control of the disease is stated to have been afforded by five sprayings with Bordeaux mixture in concentrations from 0·5 to 1·5 per cent., the stronger solutions being used later in the year.

DEIGHTON (F. C.). **Mycological section.**—*Ann. Rept. Lands and Forests Dept. Sierra Leone for the year 1927*, pp. 13–17, 1928.

During 1927, a black spot disease agreeing with that caused by *Colletotrichum* [? *Glomerella cingulata*] was commonly noted on the fruits and young shoots of old avocado trees at Njala, Sierra Leone.

The Lacatan variety of banana was found to be susceptible to Panama disease [*Fusarium cubense*].

Great losses of French beans [*Phaseolus vulgaris*] were caused by a disease associated with a species of *Rhizoctonia* on the leaves and a *Cercospora* which caused greyish-brown spots on the leaves, leaf stalks, and stems. The leaves shrivelled and fell off, and large cankers were often present at the base of the stem.

Tolyposporium penicillariae [*R.A.M.*, vii, p. 231] is common on bulrush millet [*Pennisetum typhoideum*] in many parts of the Colony, and causes considerable loss as in some areas over 15 per cent. of the grains of each ear are affected.

Old cassava roots at Njala were rotted by *Sphaerostilbe repens.*

Oil palms [*Elaeis guineensis*] were affected by a disease resembling crown rot [ibid., v, pp. 79, 653], but some are apparently recovering. *Thielaviopsis* (?) *paradoxa* was associated with a rot of the young leaves of this host.

Blast of young upland rice, associated with a species of *Piri-*

cularia, was observed at Njala, a similar condition also associated with *Piricularia* sp. being noted on *Eleusine indica*.

A disease of *Poinciana regia*, in which the roots and branches on one side were killed, was attributed to *Theissenia pyrenocrata* (? Theiss.) Maubl. *Fomes pachyphloeus* commonly attacks *Parinarium excelsum* in the Southern Province and seems to be specific to it. At Njala, the same host was attacked by *Ganoderma lucidum*.

Other records listed include *Ephelis japonica* on *Digitaria* (?) *seminuda* and *Paspalum scrobiculatum* at Njala, and *Phyllachora sphaerospora* on *Pennisetum gracile*, *P. polystachyum*, and *Paspalum scrobiculatum* at Freetown.

A year's progress in solving farm problems of Illinois, 1927–28. —*Forty-first Ann. Rept. Illinois Agric. Exper. Stat. for year ended June 30, 1928*, 321 pp., 38 figs., 13 graphs, 2 maps, 1928. [Received February, 1929.]

This report contains the following references of phytopathological interest other than those already noticed from different sources. The results of three years' tests [which are tabulated and discussed] show that selection of healthy maize seed for planting has no appreciable effect on the incidence of the rots due to *Diplodia* [*zeae*], *Gibberella* [*saubinetii*], or *Basisporium* [*gallarum*: *Nigrospora sphaerica*: *R.A.M.*, vii, p. 428]. There was, however, a distinctly lower proportion of *Fusarium* [*moniliforme*] rot [*G. moniliformis*] in the stands grown from horny selected seed. In 1925 all the rots were more severe on late- than on early-planted seed, but in 1924 and 1927 this correlation was not apparent. In 1927 seed treatment with Bayer dust, improved semesan jr., or S.F.A. 225 (2 oz. per bushel) was particularly beneficial in the case of infection by *D. zeae* and *G. saubinetii*, increased yields of 16 and 9·7 bushels per acre, respectively, being obtained [ibid., vii, p. 713]. The yield of *Fusarium*-infected seed was increased by 4·1 bushels per acre as a result of seed treatment, but this process was less effective in the case of seed attacked by *Cephalosporium* [*acremonium*], *N. sphaerica*, or scutellum rot [ibid., vii, p. 28].

Blister canker [*Nummularia discreta*] in Ben Davis apple orchards has proved amenable to control by the systematic excision of cankers where the incidence of infection does not exceed 15 per cent.

Only a few of the several hundred seedlings of *Pyrus calleryana* and *P. ussuriensis* undergoing tests for resistance to fireblight [*Bacillus amylovorus*] have given satisfactory results, and general statements as to the alleged immunity of these species are considered to be misleading. The Favorita pear, for instance, was definitely eliminated during the season under review on account of susceptibility. Owing to the severity of fireblight in Illinois the pear has been abandoned as a commercial crop except in a few localities where the inferior Kieffer variety is cultivated.

Heavy losses from bacterial spot of peach [*Bacterium pruni*] in 1927 again emphasized the need for a reliable means of control. Good results have been obtained with sodium silico-fluoride (2 lb.

per 50 galls. water), but this preparation is apt to cause serious dropping of the fruit and some foliage injury.

The collar and root rot of fruit trees [ibid., vi, p. 562] is stated to be steadily gaining ground in Illinois, especially in young orchards. The disturbance is believed to be primarily due to adverse weather conditions.

Virus diseases of raspberries are increasing in prevalence. The Perfection variety has been found very susceptible to mosaic, while the everbearing St. Regis is resistant [cf. ibid., vii, p. 727]. Besides the Royal and Quillen black raspberries [*Rubus occidentalis*], the Black Pearl, Cumberland, Honey Sweet, and Older varieties have produced progeny showing varying degrees of resistance to anthracnose [*Plectodiscella veneta*: ibid., viii, p. 52]. The range of susceptibility suggests that this quality is determined by more than one genetic factor. In blackberries anthracnose was adequately controlled by two applications of lime-sulphur (delayed dormant and pre-bloom) without the addition of an adhesive; Bordeaux oil emulsion was less efficacious.

Several promising strains of Greater Baltimore, Marvana, Louisiana Red and Pink, and Marglobe tomatoes are undergoing trials for resistance to wilt [*F. lycopersici*: ibid., vii, p. 750]. Some of the hybrids between the susceptible Grand Rapids variety and the resistant Marglobe, Marvana, and Louisiana Pink appear to have inherited the desirable qualities of both parents.

Cladosporium leaf spot of peonies [*C. paeoniae*: ibid., iii, p. 138] has been found to occur most severely on the Felix Crousse, Couronne d'Or, and Augustin d'Hour varieties. The incidence of infection was reduced to about one-half by spraying with 4–4–50 Bordeaux mixture in June after flowering.

GILMAN (J. C.) & PORTER (D. R.). **Observations on plant diseases in Iowa from 1924–1926.**—*Proc. Iowa Acad. Sci.*, xxxiv (*1927*), pp. 95–110, 2 graphs, 2 diags. [Undated, received September, 1928.]

Notes are given on the incidence of the principal crop diseases in Iowa during the triennial period, 1924 to 1926, the following being some of the more interesting records.

Dry rot of maize (*Basisporium gallarum*) [*Nigrospora sphaerica*: see preceding abstract] was very serious during this period, largely owing to the heavy rainfall during September (especially in 1925 and 1926) after the partial ripening of the crop. In these two seasons the incidence of infection amounted to 8 and 12 per cent., respectively. *Diplodia zeae* was severe in 1924 and 1926. *Puccinia sorghi* [*P. maydis*], the aecidial stage of which occurs on *Oxalis europea*, reduced the yield by 2 per cent. in 1925, when warm, wet weather favoured its development in June.

Blast of oats [see below, p. 303] caused heavy damage (7 per cent. of the crop destroyed) in 1926. Stem rust (*P. graminis*) occurred in an epidemic form on oats in 1926, causing a loss of 10 per cent. of the crop. The severity of crown rust of oats (*P. coronata*) [*P. lolii*] seems to be more dependent on the presence of buckthorn [*Rhamnus* spp.], its alternate host, than is the case with stem rust and barberry. The most prevalent and serious disease of wheat

during 1924–26 was leaf rust (*P. triticina*), *P. graminis* being of relatively slight importance.

Lucerne was severely attacked by downy mildew (*Peronospora trifoliorum*) in 1924.

Asparagus rust (*Puccinia asparagi*) caused a loss of 6 per cent. in 1924 and 1925, but in 1926 the reduction amounted to only 3 per cent. owing to the drought.

The loss to the bean [*Phaseolus vulgaris*] crop from mosaic was estimated at 5 per cent. in 1924 and 1925, and at 6 per cent. in 1926. Cabbage yellows (*Fusarium conglutinans*) was even more destructive in 1926 than 1924 and 1925 (30 per cent. loss compared with 20 per cent.). The Iacope strain [ibid., viii, p. 213] maintained its resistance even under the unfavourable conditions of 1926.

Cucumber mosaic caused serious damage in all three seasons, the losses amounting to 15 per cent. in 1924 and 1926 and 7 per cent. in 1925. In 1924 wilt (*Bacillus tracheiphilus*) also caused a reduction of 15 per cent. in both the cucumber and cantaloupe crops. Cantaloupes and watermelons were severely attacked by anthracnose (*Colletotrichum lagenarium*) in 1924 and 1926 (25 per cent. loss). Mosaic caused a reduction of 5 per cent. in the cantaloupe crop in 1924 and 1925 and 6 per cent. in 1926.

Sweet potato wilt (*F. batatatis*) caused 25, 10, and 8 per cent. loss, respectively, during the years under review, the corresponding figures for black rot (*Sphaeronema fimbriatum*) [*Ceratostomella fimbriata*] being 9, 5, and 2 per cent.

In 1926 the dry spring prevented the development of the ascospores of apple scab (*Venturia inaequalis*), the incidence of which fell to 1 per cent. compared with 10 and 2·5 per cent., respectively, in 1924 and 1925. Winter injury to apples in 1925 usually took the shape of body canker, accompanied by stunting of the foliage, which was killed or discoloured by the subsequent drought. Such trees were often invaded by blister canker (*Nummularia discreta*) or black rot (*Physalospora malorum*) [*P. cydoniae*].

Department of Botany and Plant Pathology.—*Oregon Agric. Exper. Stat. Director's Bienn. Rept. 1924–1926*, pp. 90–96, 1926. [Received February, 1929.]

In addition to items noticed from other sources, the following points are of interest in this report. Rugose mosaic spreads more rapidly than the other virus diseases of potato occurring in Oregon, and is more difficult to control [*R.A.M.*, v, p. 655]. In order to be effective, roguing must be done early and thoroughly. In a plot with about 12 per cent. of rugose mosaic, where roguing was started early and continued at intervals throughout the season, the incidence of infection in the following year was only 5·4 per cent., whereas in another plot rogued twice late in the season the amount of mosaic increased from approximately 12 to 16·4 per cent. In another case the incidence of this disease was reduced from 4·5 to 2·2 per cent. by early and repeated roguing. At best this process can only keep the disease in check and should not be relied upon for complete elimination, which cannot be effected except by eye-indexing the tubers for the foundation seed stock.

Loganberries [*Rubus loganobaccus*], blackberries, and black rasp-

berries [*R. occidentalis*] are affected by a mild type of what is apparently mosaic, but the disturbance has not yet been definitely traced to a virus. Cumberland black raspberries are subject to streak [ibid., vii, p. 793], the introduction of which has been traced to New York stock. Four years' observations show no apparent decrease in the vitality of affected plants. The streak symptoms are masked during most of the year. The causal organism of blue stem of black raspberries is stated to be indistinguishable from that of potato wilt (*Verticillium albo-atrum*) [ibid., vii, p. 176]. Raspberries planted on soil bearing potatoes the previous year usually begin to show a high percentage of mortality by the third year, while potatoes planted on land cleared of black raspberries fail to yield commercial crops on account of wilt.

An affection of strawberries known as 'crinkle' in the Marshall, Nick Ohmer, Magoons, and New Oregon varieties is believed to be due to a virus, which may also be the cause of a witches' broom effect in the Ettersburg 121 variety [cf. ibid., vii, p. 651].

Memoria de los trabajos desarrollados por la Oficina Federal para la Defensa Agricola del 1° de Enero de 1927 al 30 de Noviembre de 1928. [Report of the work carried out by the Federal Bureau of Agricultural Defence from 1st January, 1927 to 30th November, 1928.]—141 pp., 8 pl., 17 figs., 1 graph, 1928.

This report, which comprises an account of the organization and activities of the different branches of the Mexican Agricultural Defence Service and a description of the plant quarantines in force, also contains the following references of phytopathological interest. Laboratory studies in connexion with the suspected infection of plantains by Panama disease (*Fusarium cubense*) confirm the opinion already expressed [*R.A.M.*, viii, p. 257], namely, that the symptoms are due to bacterial invasion.

Coffee suffers severely from the attacks of *Stilbum flavidum* [*Omphalia flavida*: ibid., v, p. 160] and *Corticium koleroga*. The application of Bordeaux mixture with casein is recommended in both cases.

A very serious case of potato blackleg, apparently due to *Bacillus phytophthorus* [*B. atrosepticus*: ibid., iii, p. 164], is undergoing investigation.

KAUFFMANN (F.). **Zur Tumefaciensfrage.** [Contribution to the *tumefaciens* problem.]—*Zeitschr. für Krebsforsch.*, xxviii, 2, pp. 109-120, 1928.

A full account is given of the writer's recent investigations, at the Robert Koch Institute, Berlin, on the rôle of *Bacterium tumefaciens* in the etiology of cancer [*R.A.M.*, vii, p. 622].

Tumours were readily produced on sunflowers and sugar beets by inoculation with various strains of this organism, control inoculation with *Bacillus coli* and other organisms, or with sterile bouillon, giving negative results. In sunflower seedlings the organism was recovered from the tumours five weeks after inoculation, and in sugar beets after nine to ten weeks, but in older sunflower plants reisolation failed after eleven days.

All attempts at the production of tumours by means of the so-called '*tumefaciens* plastin' (a supposedly active principle present in the sterile culture filtrate) [ibid., vi, p. 537] gave negative results on sunflowers and carrot slices. It would seem, therefore, that the living organism alone is capable of inducing tumour development.

Contrary to the experience of d'Hérelle and Peyre (*Comptes rendus Acad. des Sciences*, clxxxv, 3, p. 227, 1927), the bacteriophagous lysin was found to exert no action either in tumour production or its prevention.

Negative results have been obtained in all the inoculation experiments (about 200) with various strains of *Bact. tumefaciens* on animals carried out during the last three years under a wide range of conditions. This is thought to dispose of the theory that this organism is implicated in the causation of human and animal cancers. In view of its ubiquitous nature, its occasional presence in carcinomata is not surprising.

LAYCOCK (T.). **An investigation of the causes of mouldiness of cured Cacao.**—*Seventh Ann. Bull. Agric. Dept. Nigeria*, pp. 5–16, 2 pl., 2 charts, 1928.

Experiments [which are described] conducted to ascertain the causes of mouldiness in cured cacao beans showed that under humid conditions fermented cacao beans become mouldy much more readily than do unfermented ones. Fermented beans are more permeable to moisture than are unfermented beans and the husk is the part chiefly concerned in the reabsorption of moisture. The greater liability to mould shown by fermented cacao is partly due to this excess of moisture and partly to the hydrogen-ion concentration as determined in extracts from the husks; if fermented husk extract is acidified the development of moulds is inhibited, while if unfermented husk extract is made more alkaline fungal growth is greater than on the same extract untreated. The difference in the chemical composition of the two kinds of husks is also thought greatly to affect the amount of mould.

It is recommended that cacao should be thoroughly graded in the field; fermentation should be effected in boxes in open sheds, as a protection against rain, and the larger the quantity treated the better will be the fermentation, with correspondingly less risk of mould. Care should be taken to facilitate good drying in the initial stage, and storage, under Nigerian conditions, should be as short as possible.

The fungi isolated during the experiments were mostly species of *Aspergillus*.

CRAIGIE (J. H.). **On the occurrence of pycnia and aecia in certain rust fungi.**—*Phytopath.*, xviii, 12, pp. 1005–1015, 3 figs., 1928.

Further data are given on the heterothallism of *Puccinia graminis* [*R.A.M.*, vii, p. 47]. When barberry leaves were inoculated with sporidia from germinating teleutospores some of the resulting pustules developed from the growing together of the mycelia developed from two sporidia, while others resulted from a

single sporidium only. In 59 of the former compound type, 24 developed aecidia, while in 174 of the simple (monosporidial) pustules only 11 gave aecidia and some of these were probably incorrectly classed as simple or received a fortuitous admixture with nectar containing pycnospores from other pustules. When precautions were taken to avoid this last source of error in greenhouse experiments with *P. helianthi*, few if any of the simple pustules bore aecidia.

The fact that simple pustules of *P. coronata* [*P. lolii*], *P. pringsheimiana*, *P. graminis*, and a species of *Gymnosporangium* (possibly *G. corniculans*) occur under natural conditions on their respective aecidial hosts (*Rhamnus cathartica*, gooseberry, *Berberis vulgaris* var. *purpurea*, and *Amelanchier alnifolia*), indicates that these rusts are also heterothallic.

Pustules of *P. lolii* and *P. pringsheimiana*, as well as *P. graminis*, have been found in nature bearing aecidia in only one sector of each pustule. Greenhouse experiments with *P. graminis* and *P. helianthi* showed that similar conditions could be obtained by applying nectar containing pycnospores to one side of the monosporidial pustule, a result which is regarded as further confirmation of the heterothallic nature of *P. lolii* and *P. pringsheimiana*.

CLARK (J. A.) & SMITH (R. W.). **Inheritance in Nodak and Kahla durum Wheat crosses for rust resistance, yield, and quality at Dickinson, North Dakota.**—*Journ. Amer. Soc. Agron.*, xx, 12, pp. 1297–1304, 1928.

The data obtained on F_3 material of a cross between the rust. [*Puccinia graminis*] resistant wheat variety, Nodak, and the susceptible Kahla indicate that susceptibility is dominant to resistance. Only 3 out of 89 of the resulting lines were found to be homozygous for resistance, denoting the probable presence of two or more genetic factors for rust reaction.

RODENHISER (H. A.). **Physiologic specialization in some cereal smuts.**—*Phytopath.*, xviii, 12, pp. 955–1003, 13 figs., 5 graphs, 1928.

A detailed study was made of 14 physiological forms of *Ustilago tritici* from various parts of the United States, Europe, Egypt, and New South Wales; 12 of *U. nuda* (United States and Europe); 7 of *U. hordei* (United States and Italy); 5 of *U. levis* (United States and China); 18 of *U. avenae* (United States and Europe); 3 of *Tilletia levis* (Hungary, Minnesota, and Egypt); and 2 of *T. tritici* (New Zealand and Norway).

The differences between physiological forms in culture are sometimes very pronounced, but they can only be detected when the proper media, e.g., 2 per cent. dextrose agar, are used. The differences in cultural characters between various forms of *U. nuda* may be much greater than those between the so-called species, *U. tritici* and *U. nuda*. Indeed, at 30° C., a distinct similarity was observed between a strain of *U. nuda* from Hungary and one of *U. tritici* from Egypt. In the writer's opinion the morphological differences between these two organisms are insufficient to justify

their separation into species, and it is proposed that they should be considered merely as physiological forms [cf. *R.A.M.*, iv, p. 248]. A similar relationship exists between *U. levis* and *U. avenae*.

Differences were also observed in the physio-chemical reactions of certain physiological forms of *U. tritici*, *U. nuda*, and *U. hordei*. Variations were noticed in the optimum temperatures for development and in the amount of growth at different temperatures. A counter-clockwise type of growth in plate cultures is characteristic of certain forms of *U. nuda*, but this type of growth was found to be dependent on temperature, being absent at some temperatures and present at others.

All the morphological forms described by Sartoris [ibid., iv, p. 269] in cultures of *U. tritici* were observed by the author, who obtained the development of smut spores (chlamydospores) of both this species and of *U. nuda* in his cultures.

Different kinds of oats were found to vary greatly in their reaction to *U. avenae* and *U. levis*. Thus, Markton, Black Mesdag, Golden Giant, and *Avena brevis* were immune, *A. strigosa* and varieties of *A. sterilis* generally resistant, and most of the varieties of *A. sativa* and *A. sativa orientalis* susceptible [cf. ibid., vii, p. 627].

None of the wheat varieties tested was immune from *T. levis* and *T. tritici*, but the durums, as a class, were found to be more resistant than the common types. *T. levis* and *T. tritici* both comprise distinct physiological forms recognizable by their respective degrees of virulence on Kota, Marquis, Pentad, and einkorn wheats. The form of *T. tritici* from Norway was found to be much more virulent than that from New Zealand.

Two forms of *U. hordei* can be distinguished by their parasitic behaviour on Lion and Himalaya barley [cf. ibid., iv, p. 214]. Lion is immune from the Minnesota strain and susceptible to an Italian one, while in Himalaya the reaction is reversed.

Sectors differing from their parents in colour and growth rate occurred in cultures of *U. hordei* and *U. avenae*.

DICKINSON (S.). **Experiments on the physiology and genetics of the smut fungi. Cultural characters. Part I. Their permanence and segregation.**—*Proc. Roy. Soc. London*, Ser. B, ciii, B. 726, pp. 547–555, 1 pl., 1928.

In continuation of his earlier investigations [*R.A.M.*, vii, p. 151] the author describes experiments in which a chlamydospore (smut spore) of *Ustilago levis* was isolated and allowed to germinate on a suitable medium, the first sporidium formed by each of the four segments of the promycelium being isolated, transferred to test-tube slopes, and allowed to develop in culture, the process being repeated with a number of smut spores of known parentage.

The results obtained [which are tabulated and discussed] showed that the strains from each of the four sporidia frequently differed in various cultural characters [which are indicated and figured] from one or more of the other three strains arising from the same smut spore.

The segregation of the cultural characters in the four cultures

from a smut spore was on a 2 : 2, 3 : 1, or 4 : 0 basis (all four being similar in the latter case); it is deduced that it may take place in either of the reduction divisions of the fusion nucleus. The segregation of any one character was independent of that of any other.

The strains remained constant while in culture, and the cytoplasm appeared to have no determining influence on the cultural characters.

SCHRIBAUX & JAGENAUD. **Expérience de traitement à sec de la carie sur les Blés de printemps.** [Experiments in the treatment of bunt on spring Wheats by dusting.]—*Comptes rendus Acad. d'Agric. de France*, xiv, 37, pp. 1270–1275, 1928.

In the Tarn, and the south of France generally, the spring wheat crops are very liable to contain a large percentage of grains damaged in threshing, which are destroyed by treatment with copper solutions for the control of bunt [*Tilletia tritici* and *T. levis*: *R.A.M.*, viii, p. 94]. In a recent experiment a lot of mixed seed-grain of the Ardito variety and a Tunisian wheat was dusted with vitrioline [ibid., vi, p. 280]. The former proved to be virtually free from bunt, while in the latter the incidence of infection was reduced from 10·5 per cent. to a trace in the treated plot. The dry treatment is particularly recommended for such varieties as Carlotta Strampelli, L'Inversable × Carlotta, and Ardito, which are very apt to be injured in threshing.

BLUNCK (G.). **Příspěvek k otázce moření osiva za sucha.** [Contribution to the problem of dry disinfection of cereal seed.]— —*Ochrana Rostlin*, viii, 4, pp. 97–103, 1928.

Some details are given of a large number of experiments in which various dusts and a wide range of chemicals were tested for their germicidal action on wheat, rye, barley, and oats seed-grain artificially infected with spores of the hay bacillus [*Bacillus subtilis*]. Caffaro dust, tillantin, tutan, and analyz II proved to be either ineffective against the organism or injurious to the germinability of the seed, thus confirming the unfavourable reports frequently received from growers using them. Mercuric chloride mixed with common salt [proportions not indicated] gave satisfactory results, especially when the treated seed was allowed to remain a few weeks before testing. Organic mercury compounds were still more efficacious, but have the disadvantage of high cost and are not always harmless to the seedlings. Formalin powder prepared by admixture with stearine soap was found to kill all pathogenic germs usually present on the seed, and is well suited for seeds with a rough surface, e. g., oats and beet, but on wheat it may prove detrimental to germination at fungicidal doses. Excellent results were, however, obtained with a combination of an organic mercury compound [not specified] and the above-mentioned formalin dust, which will be shortly issued to the trade under the name 'hagenol'. The tests so far made with this preparation have shown it to be highly fungicidal and absolutely innocuous to the seedlings.

In concluding, the author stresses the poisonous nature to man and animals of all fungicidal dusts, and the necessity for special

precautions in handling them. In his opinion, they should not be sold in paper bags, but in tins visibly marked 'Poison', and treated seed should never be fed to animals. His experiments have also shown that clean seed is more easily disinfected than dirty seed, especially when the latter contains defective and broken grains; these, however, can easily be removed by sifting and winnowing.

ZIMMERMANN (W.). **Geht Quecksilber aus Saatgut-Beizmitteln in das geerntete Korn und in das Mehl über?** [Does mercury from seed-grain disinfectants find its way into the harvested grain and into the flour?]—*Zeitschr. für Angew. Chemie*, xli, 51, pp. 1336–1337, 1928.

The results of colorimetric and titrimetric analyses [by methods which are described] showed that appreciable quantities of mercury find their way from seed-grain (barley and oats) treated with mercurial disinfectants into the growing plant and thence into the grain and the flour made from the latter. It is pointed out that the cumulative effects of mercury consumption may be serious both in man and animals, and further quantitative investigations are recommended. The mercury content of various standard fungicides was found on analysis to be as follows: uspulun 16·8 per cent., germisan 16·1, agfa 13·3, abavit B (used in the above tests) 6·7, tillantin R. 3·4, and tillantin liquid [uspulun-universal] 3·3 [cf. *R.A.M.*, vii, p. 796].

SCHAFFNIT (E.) & WIEBEN (M[AGDALENE]). **Untersuchungen über den Erreger der Federbuschsporenkrankheit Dilophospora alopecuri (Fr.) Fr.** [Investigations on the causal organism of the plumed spore disease *Dilophospora alopecuri* (Fr.) Fr.]—*Forsch. auf dem Gebiet der Pflanzenkrankh. u. der Immunität im Pflanzenreich*, v, pp. 3–38, 4 pl. (2 col.), 7 figs., 1928.

Since 1924 the authors have been engaged on a study of the plumed spore disease of wheat and rye (*Dilophospora alopecuri*) [*R.A.M.*, vii, p. 11], a brief survey of the previous literature on which, and the damage which it has caused to cereal crops in Germany, is given.

The results of these investigations do not entirely agree with those obtained by Atanasoff [ibid., iv, p. 409], especially as regards the part played by eelworms (*Tylenchus tritici*) in the etiology of the disease. In the writers' inoculation experiments [full details of which are given], young wheat and rye seedlings were infected both through the agency of the mycelium of *D. alopecuri* from diseased seed-grain and by the pycnospores, without the intervention of *T. tritici*. The eelworms are evidently not indispensable to the development of infection, though they probably assist in dissemination. Both the eelworm galls and the fungus remain in untreated seed-grain and are thus indefinitely perpetuated in association. As *T. tritici* very seldom attacks rye, it is suggested that *T. dipsaci* may transmit infection to this host.

The first symptom of the disease is the undulation and spiral rolling of the young leaves. Later pale spots, sometimes dark-bordered and afterwards becoming altogether dark, appear on the foliage. The minute black dots occupying these lesions are the

ostioles of the pycnidia. Two types of disease may be distinguished by the beginning of tillering, viz., stunting, and malformation of the ears. In plants affected by the former symptom, most or all of the spikelets of the fructification are killed, and bear the pycnidia of *D. alopecuri* on the dry tissues as well as on the leaf spots. In the second type of infection the fungus produces a luxuriant mycelium, which envelops the ear within the leaf sheaths; later the typical sclerotial crust is formed over the whole or a part (mostly the apex) of the blackened ear. This form of the disease coincides with the occurrence of humid conditions during tillering. In many cases the ears fail wholly or partially to emerge owing to their adhesion to the leaf sheaths by means of the mycelium. The blade continues to grow, with the result that the upper internodes are bent outwards in fantastic shapes.

According to researches (embodied in a thesis in 1924) conducted by the senior author's student, Lindemann, the mycelium of *D. alopecuri* extends at first in the cells in the ground parenchyma between the vascular bundles, causing a yellow discoloration. After the cell contents are exhausted the walls are attacked, turning dark brown and finally disappearing. When the mesophyll tissues are completely destroyed, the vascular bundles, beginning with the phloem cells, are invaded. By the time the mycelium can be detected in the vascular bundles the phloem is so far disintegrated that neither the sieve-tubes nor companion cells are recognizable. In severe cases the rachis and glumes are permeated by the fungus and sterility results. In less heavily infected plants the grain may become more or less infected, the mycelium being confined to the testa. In the leaf blades also the parenchyma between the vascular bundles is completely destroyed, but the vascular bundles themselves are seldom invaded. The assimilatory parenchyma of the leaf sheaths is less severely infected; the cell walls here, though badly discoloured, mostly remain intact.

The morphological, physiological, and biological characters of the fungus are described in detail, a full account being given of its behaviour in culture on various media. The average diameter of the pycnidia, which are always covered by the epidermis of the host or by a thin but firm mycelial layer, is 300 μ, and the pycnospores measure 11 by 2 μ. Tapering, fusiform, tri-septate, hyaline conidia, measuring 36 by 2·5 μ and also supplied with plumes like those of the pycnospores, are formed singly or in groups on free hyphae or short conidiophores. Perithecia were not observed, and the reference of this fungus as a stage in the life-history of *Dilophia graminis* is not considered to be justifiable. The conidial form, *Mastigosporium album*, is also considered to be a distinct organism.

The optimum temperature for mycelial growth was found to be 25° C., with a maximum and minimum of 30° to 34° and 4°, respectively. The pycnospores and conidia also germinated best at 25°, the maximum and minimum being 30° and 8°, respectively. Cultures on fragments of straw left in the open or buried 25 cm. deep in the soil were still viable in the spring. The sclerotial crusts were viable after 1½ years in the open and pycnospores after 10 months.

In partially infected ears cultures from the testa of the grain yielded the pycnidia. On the germination of the seed the mycelium was found to grow out and surround the germinating grain with a white weft of hyphae. Experiments showed that the shoot is not readily infected in the early stage, but a sufficient number of positive results was obtained to indicate that seed-borne infection is probable. There was some evidence that the form of the fungus on rye will not affect wheat, and vice versa.

BARTELS (F.). **Studien über Marssonina graminicola.** [Studies on *Marssonina graminicola.*]—*Forsch. auf dem Gebiet der Pflanzenkrankh. u. der Immunität im Pflanzenreich,* v, pp. 73–114, 1 col. pl., 18 figs., 1928.

A full account is given of the author's etiological, morphological, cultural, and biological investigations on *Marssonina graminicola* [*Rhynchosporium secalis*: *R.A.M.*, viii, p. 166]. The name *M. graminicola* (Ell. et Ev.) Sacc. is preferred to *R. graminicola* (used by Frank and Heinsen in 1897 and 1901, respectively), *M. secalis* Oud. (1897), and *Gloeosporium graminicola* Ell. et Ev., all of which are regarded as synonyms. An amended diagnosis of the organism is given in German.

The symptoms of the leaf blotch caused by this fungus on barley and rye are described in detail [loc. cit.]. On barley, English ryegrass (*Lolium perenne*), and other species of *Lolium*, in an advanced stage of infection, the greyish-blue centres of the lesions turn a dingy greyish-white, with dark brown edges; the surrounding pale yellow zone is hardly distinguishable from the rest of the yellow leaf. Large portions of the diseased tissues fall out and often only the midribs of the leaves remain. On rye, *Holcus lanatus*, and other susceptible Gramineae the centres of the spots assume a reddish-yellow, bluish-grey, and reddish mottling, while the edges turn dark yellow to brownish. Later the centres become reddish-brown and lose their mottled appearance, while the edges turn yellowish-brown. There is no disintegration of the tissues, as in barley.

In old cultures intercalary, terminal, or stipitate gemmae are formed; these immediately germinate by budding or in the ordinary way, and are considered to play no part in the overwintering of the fungus, which persists in the form of mycelium and conidia on the leaves and also in the soil. The close interweaving of the intracellular hyphae leads to the formation of sclerotial bodies, the shape of which resembles a flat, narrow-brimmed hat.

Infection usually occurs by the penetration of the germ-tube through the stomata; more rarely it enters directly into the epidermis.

The incubation period of *R. secalis* varies according to the host, lasting 9 to 11 days in *Hordeum* spp. and 10 to 14 days in the other susceptible Gramineae.

The optimum temperature for mycelial and conidial growth and germination was found to be 19° to 21° C., with maxima and minima at 30° to 31° and 2° to 3°, respectively. The mycelium was found to be very resistant to freezing. All attempts to induce the development of a perfect stage gave negative results.

R. secalis is not split up into physiological forms but is a plurivorous parasite. Cross-inoculation experiments between barley, wild barley (*H. murinum*), rye, *Poa*, *Bromus*, and *Lolium* spp., *Agrostis stolonifer*, *Cynosurus cristatus*, *Triticum repens*, *Phleum pratense*, and *H. lanatus* gave positive results. None of the standard varieties of barley and rye proved immune from infection. Among the most susceptible barley varieties are Bensing's Imperial, Heil's Franken, and Ackermann's Danubia (summer), and Ackermann's Viktoria, and Janetzki's Frühe (winter). Both oats and wheat resisted all attempts at artificial infection and may be regarded as immune from this fungus.

MACKIE (W. W.). **Inheritance of resistance to blast in Oats.**—Abs. in *Phytopath.*, xviii, 11, p. 948, 1928.

Blast [see above, p. 293] is responsible for sterility, blanching, and dwarfing of the spikelets of oats, causing severe crop losses. Many attempts at the isolation of a causal organism have failed, while it is also impossible to explain the disease on the basis of malnutrition. Prolonged observations with over 300 varieties of oats indicate that varietal resistance is relatively stable. A cross between Kanota, a virtually immune variety, and the susceptible Richland gave all susceptible plants in the F_1 generation. In the F_2 generation the following reactions were observed: highly susceptible 108, moderately susceptible 356, and almost or quite immune 178. These numbers suggest a 1 : 2 : 1 Mendelian ratio, with a single factor for blast resistance.

RIVES (L.). **Sur un cas de fatigue du sol. La maladie des céréales semées sur défrichement du sol.** [On a case of soil exhaustion. The disease of cereals sown on cleared ground.]—*Journ. d'Agric. Prat.*, xcii, 51, pp. 491–494, 1928.

Of recent years the writer has made observations on a dying-off of cereals on land cleared of vines in the Haute-Garonne. The leaves of affected plants (especially grey oats) assume a reddish discoloration of the base and make little or no further growth after reaching a height of 12 cm. or thereabouts. Red Algerian oats, barley, wheat, and rye are less severely attacked. The diseased roots present a coralloid aspect and are covered with small nodules, which contain no bacteria and appear to be simply stunted radicles. The cell nuclei are distinctly hypertrophied. Various species of fungi (especially *Pythium*) were isolated from the affected roots, but in every case these were found to be of secondary importance. It was impossible to infect wheat and oats by contamination of the soil with diseased roots, and it is further evident from various other considerations that the disturbance is due to physiological factors.

Finding certain analogies between the French cereal disease and that known as grey speck [reclamation disease: *R.A.M.*, vii, p. 469], the writer carried out a series of tests in the control of the former by manganese sulphate and copper sulphate (1 gm. of each per pot). The results of these experiments were extremely promising, but when the same substances were applied on a large scale (manganese sulphate at 30 kg. and copper sulphate at 150 kg. per

hect.) no beneficial effects were obtained. Plants grown in diseased soil which had been dried and aerated from August to December developed no pathological symptoms.

Merkenschlager (F.) & Klinkowski (M.). **Sind Weissährigkeit und Dörrfleckenkrankheit des Hafers als verschiedene Krankheitsformen einer gleichen physiologischen Störungsgruppe aufzufassen?** [Are white ear and grey speck disease of Oats to be regarded as varying pathological manifestations of an identical physiological group of disturbances?]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, viii, 11, pp. 104–105, 1928.

Discussing the ecological relations of oats, the authors point out that the osmotic tension of this cereal is low (maximum 20 atmospheres). This is due to its hygrophytic origin. Oats thrive in rainy seasons, when the water supply in the soil is plentiful. In consequence of their inability to accumulate salts and their marked transpirational activity, oats are not adapted to winter cultivation. They readily incline to withering and reddening of the foliage when the water supply is curtailed, and there can be no doubt that grey speck [see last abstract] is primarily due to the same cause. In the soils of localities exposed to the drying influence of the wind, e. g., on the west coast of Holstein, the cells of the oat plants are irretrievably damaged by the sudden access of unassimilable salts, and the formation of spots begins. In alkaline soils the water deficiency is more detrimental to the oats than in acid ones, since the former in any case are less well suited to the cultivation of this crop.

White ear disease [*R.A.M.*, vii, p. 269] is considered to be simply another manifestation of the same primary factor. In certain varieties the symptoms of chlorophyll deficiency are most marked at the ear, and thus lend a somewhat different aspect to an identical constitutional derangement. White ear, like grey speck, occurs as a sequel to abrupt climatic alternations (frost and heat). According to O. Kaufmann (*Arb. Biol. Reichsanst. für Land- und Forestw.*, xiii, 5, 1925), *Agrostis alba* and *Poa pratensis* are particularly susceptible to white ear. F. Pommer states (*Fortschr. der Landw.*, [iii], p. 441, 1928) that the osmotic pressure of the sweet grasses is, in some cases, far below that of oats—only 5·3 atmospheres, for instance, in *A. stolonifera*. White ear appears, from these observations, to be associated chiefly with the occurrence of sudden alterations in the concentration of salts to which the cell structure of the plants is not adjusted.

Rojdestvensky (N. A.). Отравление спорыньей в Сарапульском округе в **1926** году. [The epidemic of ergotism in the district of Sarapoul in 1926.]—*La Défense des Plantes*, Leningrad, v, 3–4, pp. 349–356, 1928.

The outcome of an official inquiry into the causes and extent of the outbreak of ergotism in 1926 in the district of Sarapoul [eastern Russia: *R.A.M.*, vii, p. 236] showed it to be mainly due to the almost universal contamination of the local rye crop with ergot [*Claviceps purpurea*] following an exceptionally prolonged spell of cold and wet weather from June to August, which greatly retarded

the flowering period and the maturation of the rye. The contamination of the grain was privately reported in some cases to be as high as 75 per cent., although official figures are much lower. Examination of trade samples of grain and flour indicated a contamination varying usually from 0·44 to 1·12 per cent., with a range from 0·2 to 2·40 per cent. Reports as to the toxic dose of ergot in consumed bread are inconclusive, on the whole, but the indications are that an admixture of up to 0·5 per cent. can be tolerated. The total number of cases treated officially for ergotism was 11,319, but many more are stated to have escaped registration, having been treated at home. The percentage of mortality was 0·8, and that of severe cases, demanding prolonged treatment, 14·3. The outstanding feature was that the epidemic lasted up to March, 1927, whereas it had been hitherto observed that the epidemics usually die down towards the end of the autumn. This fact is explained by the great poverty prevailing in the district, which forced the population to use the contaminated bread during long periods on end, and was also the cause of the large percentage of chronic cases observed. Children suffered more heavily than adults.

DUFRÉNOY (J.). **Le Grape-fruit en Floride.** [Grapefruit in Florida.]—*Agron. Colon.*, xvii, 132, pp. 177–188, 6 figs., 1928.

The author, who has recently visited Florida, gives a brief account of the citrus-growing industry there, including notes on the principal diseases affecting the trees. He states that the condition locally known as 'blight' or 'wilt' [*R.A.M.*, viii, p. 158] shows a certain resemblance to the 'mal secco' disease of citrus studied by Petri in Sicily [ibid., viii, p. 35], and that he was able to demonstrate the presence of *Colletotrichum gloeosporioides*, to which Petri has attributed the disease, in the wood of the affected branches.

SHARPLES (A.). **Palm diseases in Malaya.**—*Malayan Agric. Journ.*, xvi, 9–10, pp. 313–360, 18 pl. (2 col.), 1 fig., 1 map, 1928.

Notes are given on various diseases of coco-nuts and of the oil palm (*Elaeis guineensis*) in Malaya, especially on one of dwarf coco-nuts and oil palms caused by *Marasmius palmivorus* n. sp. [*R.A.M.*, vi, p. 656], a fungus which is also thought to be one of the main factors concerned in the death of tall coco-nut palms throughout Malaya. The heavy losses among large blocks of tall coco-nuts over 15 years old which have been prevalent since 1923 are usually attributed to lightning-strike, but the author has found them to be closely associated with *M. palmivorus*. In these large outbreaks the stems sometimes show a salmon-pink discoloration [loc. cit.], and sometimes a hardening of the tissues accompanied by a dark reddish-brown colour in the vascular bundles, surrounded by brownish-red ground tissue, in a cylinder of gradually diminishing diameter from the base to near the crown of the tree. During 1928, a block of 68 such trees was kept under careful observation. The number of diseased trees remained unaltered, but rapid defoliation and breaking of the middle leaves took place

and later the central shoot collapsed, nearly 50 per cent. of the trees succumbing. *M. palmivorus* was commonly present on the leaf bases, which it had penetrated from the upper surface to a depth of about half an inch, weakening them and leading to their fall.

The white or pinkish mycelial strands of *M. palmivorus* often form fan-shaped patches on the leaf bases and fruit bunches. The umbonate, smooth, slightly striated pileus measures $\frac{1}{2}$ to $\frac{3}{4}$ in. in diameter under dry conditions and up to 3 in. under moist; the glabrous upper surface is eosine pink, later shrimp-pink, in dry, but paler or almost white in moist conditions. The gills are pure white, thick, distant, and in old specimens are slightly detached from the stalk. The hyaline spores, slightly beaked when mature, measure 10 by 5·5 μ. The fungus is single or caespitose. On oil palms and dwarf coco-nuts it is regarded as the definite cause of a serious disease, but on tall coco-nut palms it seems to be weakly parasitic, though an important factor in accelerating the death of trees injured from other causes. Suggestions are made for the control of the disease under the conditions obtaining in the various cultivations.

Polyporus ostreiformis was associated with a root and stem disease of Areca palms (*Areca catechu*) and a stem disease of tall coco-nuts.

Diseased coco-nut roots often show black lines in the tissues, and isolations from these roots gave various fungi, especially a species of *Phoma*. Coffee plants suffering from root disease were also found bearing quite similar pycnidia. In a few cases the sclerotia of *Rhizoctonia bataticola* were found in the palm roots, but they did not appear to be associated with the black-line formation.

Reports received from Experiment Stations, 1927–1928.—277 pp., 11 pl., 49 graphs, 1 map, London, Empire Cotton Growing Corporation, 1929.

Brief notes are scattered through this volume on cotton diseases observed during the season 1927–8 at various experiment stations in the cotton-growing Dominions and Colonies of the British Empire, the following records being of interest.

At Candover, Natal (pp. 85–6), anthracnose (*Glomerella gossypii*) [*R.A.M.*, vii, p. 94] was occasionally present on bolls during 1926–7, while during the early seedling period of the following season the disease caused very prevalent spotting and marginal injury of the leaves, the growth of the seedlings being much retarded. A light attack of rust (*Kuehneola gossypii*) [*K. desmium*], not previously reported from this area, was general on ratoon plants in late February. Leaf fall due to this fungus was also observed in Zululand, where a localized attack of leaf spot (*Alternaria macrospora*) [ibid., viii, p. 171], probably associated with drought following a wet period, also occurred.

At Gatooma, Southern Rhodesia (p. 125), a mild attack of angular leaf spot (*Bacterium malvacearum*) was noted on the older leaves of some strains during January. All the local cottons, especially Bancroft, Durango, and the Barberton strains, were

affected, but not the introduced varieties, which were treated with sulphuric acid before sowing.

At Sigatoka, Fiji (p. 276), black arm (*Bact. malvacearum*) appeared first on Tanguis cotton, in some instances causing it to die back completely; later, the disease attacked both the Sudan and Egyptian strains of Sakel cotton, and slightly affected a few plants of all the varieties grown.

GOLDING (F. D.). **A first survey of insect and fungoid incidence on improved Ishan Cotton.**—*Seventh Ann. Bull. Agric. Dept. Nigeria*, pp. 17–37, 1928.

During the season 1927–8 a survey was made at Ilorin, Northern Nigeria, of the factors affecting the development of indigenous varieties of cotton, viz. the sister strains A and B of Ishan (*Gossypium vitifolium*), Ilorin (*G. peruvianum*), Kabba (? *G. vitifolium*), and Ishan E.

As regards the part played by fungal diseases, observations confirmed the view previously expressed [*R.A.M.*, vii, p. 317] as to the resistance of Ishan A and B to leaf curl, these strains again being noticeably less susceptible than the other cottons studied.

From October until early December angular leaf spot and black arm [*Bacterium malvacearum*: loc. cit.] caused much damage, while in one block bacterial lesions on the bolls were the chief cause of abscission and mummification. From 5 to 16 per cent. fewer plants were affected with angular leaf spot in blocks where they were grown through yams than in those where they were grown alone, the degree of infection also being noticeably less in the former. Similarly Ishan B grown through yams in one block was less severely attacked than the same variety in a neighbouring plot, grown alone. It is thought that the yam foliage may screen the cotton from rain-borne infection.

The *Alternaria* disease [*A. macrospora*: ibid., viii, p. 171] was important only on the earliest-flowering variety, Ilorin, in one block.

KULKARNI (G. S.) & MUNDKUR (B. B.). **Studies in the wilt disease of Cotton in the Bombay Karnatak. Series I.**—*Mem. Dept. Agric. India*, Bot. Ser., xvii, 2, 27 pp., 4 pl., 1928.

The first section of this memoir, dealing with the parasitism of the *Fusarium* fungus associated with cotton wilt in the Bombay Karnatak [*R.A.M.*, vii, p. 511], is contributed by G. S. Kulkarni; the second section, on the cause of the symptoms, being by both authors.

The fungus responsible for cotton wilt in the region in question is stated to be morphologically indistinguishable from *F. vasinfectum*. The disease, which may be seen in the fields before the plants are a fortnight old, causes an annual loss of about 5 per cent. in the Karnatak. It is apparent from the authors' inoculation experiments [details of which are given] that the fungus is a definite parasite of certain varieties and strains of cotton, and that failure to secure infection is due to inadequate methods of inoculation or unsuitable external conditions. In order to effect successful

inoculations with this fungus, it should be well mixed with the portion of the soil that the feeding rootlets are likely to reach, and not merely poured into the upper soil layers [ibid., viii, p. 102]. Inoculations should also be made before the seeds are sown and not during the growth of the plants. Once the soil has been inoculated it remains infective for at least a year. In all cases, however, the success of these inoculation experiments was only partial, varying from about 40 to 80 per cent. in some of the tests on plants growing in pots, suggesting that some other factor is necessary to enable the parasite to attack and destroy the cotton.

A study of the effect on cotton plants of solutions in which *F. vasinfectum* had grown led to the conclusion (confirmed by microscopic evidence) that the active factor in the causation of the wilt is a chemical compound or compounds resistant to boiling and not removable by passage through porcelain filters [loc. cit.]. It is also not destroyed by heating the filtrates in an autoclave at 110° to 115° C. The nature of the substance has not been determined, but lactic and oxalic acids are definitely excluded, and nitrates do not appear to be involved. The *Fusarium* solutions even caused symptoms of wilt in resistant and semi-immune types, such as Gagad 1.

TAUBENHAUS (J. J.), EZEKIEL (W. N.), & KILLOUGH (D. T.). **Relation of Cotton root rot and Fusarium wilt to the acidity and alkalinity of the soil.**—*Texas Agric. Exper. Stat. Bull.* 389, 19 pp., 5 graphs, 1928.

When *Phymatotrichum omnivorum* [*R.A.M.*, viii, p. 239] was cultivated on artificial media the maximum growth occurred at P_H 7; growth was inhibited at P_H 4·1 and 8·9. An extensive field survey of the cotton-growing areas of Texas showed that root rot due to this fungus was present in 34 per cent. of the fields having soil with a P_H value of 5·5 to 6·4, in 60 per cent. of those where the P_H value was 6·5 to 7·4, and in 71 per cent. of those where it ranged from 7·5 to 9. On the acid soils root rot seldom reached significant proportions.

Wilt (*Fusarium vasinfectum*), on the other hand, occurred in 55 per cent. of the fields with acid soils, in 13 per cent. of those with nearly neutral soils, and in only 2 per cent. of those with alkaline soils.

Root rot was found in 42 per cent. of the fields with a soil basicity (determined by treating 10 gm. soil with 100 c.c. of 0·2 N nitric acid and titrating with 0·1 N sodium hydroxide, the results being expressed as percentage basicity of calcium carbonate) of 0 to 0·9 per cent., in 80 per cent. of those with a soil basicity of 1 to 2·5 per cent., and in 81 per cent. of those where it ranged from 2·5 to 10 per cent. *F. vasinfectum* was present in 32 per cent. of the first group, 8 per cent. of the second group, and was absent from the third group.

The existence in Egypt of a strain of *F. vasinfectum* which attacks cotton on alkaline soils also [ibid., vii, p. 318] is considered to be a potential danger to American cotton.

MÉTALNIKOV (S.) & CHORINE (V.). **Maladies microbiennes chez les pyrales de Maïs (Pyrausta nubilalis Hübn.).** [Microbial diseases of Maize *Pyrales* (*Pyrausta nubilalis* Hübn.).]—*Ann. Inst. Pasteur*, xlii, 12, pp. 1635–1660, 7 figs., 1928.

A survey is given of the principal literature relating to the destruction of the caterpillars of *Pyrausta nubilalis* by fungi and bacteria [*R.A.M.*, vii, p. 577], followed by an account of experiments in the control of this pest by a number of bacteria isolated from the blood of diseased insects. *Vibrio pyraustae* and *Coccobacillus pyraustae* were found to be highly pathogenic to *P. nubilalis*.

VELU (H.). **Culture de Cryptococcus farcinimosus sur tiges de Graminées fourragères.** [Culture of *Cryptococcus farcinimosus* on stalks of fodder Gramineae.]—*Comptes rendus Soc. de Biol.*, xcix, 36, pp. 1777–1778, 1928.

Recent experiments by Brocq-Rousseu and his collaborators having shown that ringworm fungi can be cultured on substances commonly found in bedding [*R.A.M.*, vii, p. 719], the writer tested the behaviour in this respect of the causal organism of epizootic lymphangitis (*Cryptococcus farcinimosus*) [ibid., vii, p. 325]. The fungus was sown in tubes on a medium consisting of sterilized oat inflorescences, hay stalks, and green stolons of *Pennisetum clandestinum*, moistened with tap water. After three weeks at 30° C. the typical colonies of *C. farcinimosus* developed exactly as on peptonized water or other nutrient media. Sub-cultures on Sabouraud's medium gave normal colonies.

KARRENBERG (C. L.). **Die norddeutsche Pilzflora. Ergebnisse eigener Untersuchungen mit Bemerkungen über die Epidemiologie der Dermatomykosen speziell in Hamburg.** [The North German fungus flora. Results of personal investigations, with observations on the epidemiology of the dermatomycoses, especially in Hamburg.]—*Dermatol. Wochenschr.*, lxxxvii, 50, pp. 1927–1930, 1928.

Cultures from the lesions in 217 out of 400 cases of dermatomycosis examined between 1926 and 1928 at the Ritter Clinique, Hamburg [cf. *R.A.M.*, vii, p. 635] yielded pathogenic fungi, in the following order of frequency: *Epidermophyton inguinale* 92, *Microsporon audouini* or *M. hamburgense* 53, *Trichophyton faviforme* 17, *T. gypseum* 10, *T. cerebriforme* 9, *E.* Kaufmann-Wolf 6, *T. rosaceum* 4, *T. vinosum* and *Achorion quinckeanum* 3 each, *A. schoenleini*, *A. violaceum*, *M. lanosum*, *T. acuminatum*, and *E. rubrum* 2 each, and *T. exsiccatum*, *T. violaceum*, *T. plicatile*, *T. persicolor*, and *T. niveum* 1 each. Some brief observations are made on the epidemiology and prophylaxis of the dermatomycoses.

SULZBERGER (MARION B.). **The pathogenesis of Trichophytids. The spontaneous passage of formed elements (spores) from the primary lesion into the circulating blood.**—*Arch. of Dermatology*, xviii, 6, pp. 891–901, 1928.

Over 100 guinea-pigs were inoculated cutaneously with *Achorion quinckeanum* [*R.A.M.*, vii, p. 634] and 141 blood specimens from

these animals were subsequently examined at varying intervals. Sixteen of these yielded positive cultures, falling chronologically into two phases, viz., an early one (one hour to two days after inoculation), and a later one (ten to thirteen days after inoculation), with an intervening negative phase.

The fungus was recovered from the internal organs of three out of 34 inoculated animals.

The second phase of dissemination of the organism is considered to be specially interesting (*a*) as being due to a spontaneous process; and (*b*) as coinciding with the maximum of the allergy, the acme of the inflammatory process in the primary lesion, the most marked histological changes in the area of primary infection, and the beginning of the disappearance of the organism therefrom. The allergic change is assumed to constitute the basis of all these phenomena.

Since the time factors, allergic and histological changes, and the course of spontaneous trichophytic infections are similar in human subjects to those recorded here, it may be deduced by analogy that in man also internal infection occurs through dissemination in the blood stream of fungus spores originating from the primary lesion.

GUTERMAN (C. E. F.). **A preliminary report on mechanical transmission of the mosaic of Lilium auratum.**—*Phytopath.*, xviii, 12, pp. 1025–1026, 1928.

Garden and greenhouse plants of *Lilium auratum* are stated to be liable to severe infection by a virus disease of the mosaic type, which causes marked stunting, twisting and curling of the leaves, and distortion of the buds and flowers.

In a series of tests, successful transmission of this disease was obtained by inarching healthy and mosaic plants. The lower leaves were pulled off and a small slice removed with a razor from the side of each stem. The cut surfaces were then quickly bound together and waxed. The first symptom, appearing eight days after the stems were bound together, was a yellow discoloration of the veins in the basal portions of the semi-matured leaves on the side of the healthy plant next the graft. All the leaves that subsequently developed showed the typical mosaic symptoms. This is believed to be the first record of the experimental transmission of lily mosaic.

Positive results were also obtained by juice inoculations from diseased to healthy plants of *L. auratum* and other species Details of these will be published later.

McKAY (M. B.). **Narcissus and Tulip diseases.**—*Eighteenth Ann. Rept. Oregon State Hort. Soc.*, pp. 137–150, 1926. [Received March, 1929.]

In this paper popular notes are given on a number of commercially important diseases of narcissus and tulip bulbs in the northwestern United States, with brief recommendations for their control by roguing, the use of healthy bulbs for propagating, and the like.

The condition known as grey disease of narcissus, characterized by a light-green or grey mottling of the leaves, is thought to be

a form of mosaic. Affected plants do not recover, give flowers of poor quality, and grow less rapidly than sound ones. Thus, mosaic plants of the Golden Spur variety were found to have increased in weight less than half as much as normal ones under identical conditions. The Lucifer and Minister Talma varieties are highly susceptible, some beds of the latter showing 60 per cent. mosaic within one year of their importation from Holland; the Sir Watkins variety also showed as much as 80 per cent. infection. The spread of the disease, which is not transmitted by seed, appears to be slow.

Basal rot chiefly affects the Poeticus ornatus, Madame de Graaff, Henry Irving, and Bicolor Victoria varieties of narcissus, though others are also susceptible. The disease appears to be caused by a weakly parasitic fungus (not yet studied in detail) which rots debilitated or mechanically injured bulbs.

Notes are also given on 'fire' (*Botrytis tulipae*) [*R.A.M.*, viii, p. 40] and 'breaking' of tulips [ibid., vii, p. 724]. Breaking is stated to have all the characteristics of an infectious mosaic, and the recommendations for its treatment are based on this assumption. Under Oregon conditions, the disease is thought to spread much more rapidly than in Europe, owing, possibly, to the greater prevalence of insect vectors.

MACHACEK (J. E.). **A Penicillium rot of Gladiolus.**—*Nineteenth Ann. Rept. Quebec Soc. Protect. Plants*, pp. 77–86, 1 pl., 8 figs., 1927. [Received December, 1928.]

A full account is given of a storage rot of gladiolus corms in which the Alton, Gretchen Zang, War, Linton, and Maiden Blush varieties became infected naturally, and Rubini and Grant after being wounded in digging. In the Alton variety, 15 per cent. of the corms were affected.

The diseased tissues collapsed and turned dark brown, being delimited by a definite margin but with slight discoloration beyond. No prominent mycelial weft was observed.

Inoculations of healthy corms produced small, sunken lesions on the surface. These lesions enlarged rapidly in susceptible varieties, the surface of the spot afterwards cracking, allowing the lesion to dry out and leading to a depression in the centre, in which the sclerotia appeared. With resistant varieties the lesion did not exceed 1 cm. in diameter; in these also the centre was depressed, while the surface grew hard or corky and the edges were dark and wrinkled.

The hyphae were intercellular and sparse, though comparatively abundant in the vessels. The lesions were separated from the healthy tissue by a layer of cork four to ten cells deep, according to the age of the lesion.

The author considers that the organism (the cultural characters of which are described) is a new species, which he accordingly names *Penicillium gladioli*, giving a diagnosis in English [cf. *R.A.M.*, vii, p. 448].

On gelatine, potato, or potato-dextrose-gladiolus agar the colonies are lemon or sulphur yellow, whitish at the margin, the older parts being greenish from the accumulation of conidia. The conidio-

phores are short, erect, branching in two or three tiers and producing chains of spherical, smooth conidia measuring 2·25 to 3·2 μ, in a loose, fan-like mass. The very numerous sclerotia are yellow, later yellowish-brown, oval or spherical, 180 to 380 μ in diameter, and appear in culture on agar after 3 days.

Control is considered to be possible by a judicious selection of the corms when planting, care in digging, dry storage, spraying or dusting with copper carbonate or copper sulphate, and the periodic removal of diseased corms.

DODGE (B. O.). **Notes on some Iris troubles.**—*Journ. New York Bot. Gard.*, xxx, 349, pp. 5–10, 3 figs., 1929.

Bearded irises at the New York Botanic Garden have been rapidly dying out during the last few years as a result of infection by *Sclerotium delphinii* [*R.A.M.*, vi, p. 617], which also destroyed every plant in a bed of *Physostegia* near by in August, 1928. A species of *Fusarium* was frequently isolated from rotting leaves and rhizomes, but this is believed to be of secondary importance. *Bacillus carotovorus* was associated with a rot starting in the leaves and progressing downwards into the growing region of the rhizome.

PERRAULT (C.). **A common leaf spot of Iris in Quebec.**—*Nineteenth Ann. Rept. Quebec Soc. Protect. Plants*, pp. 87–103, 6 pl., 1927. [Received December, 1928.]

After a brief historical review of the leaf spot of iris caused by *Heterosporium gracile* [*Didymellina macrospora*: *R.A.M.*, vii, pp. 9, 11], the author describes the symptoms of the disease, indicates its geographical distribution and importance, and gives an account of the taxonomy, morphology, and physiology of the fungus.

In studies under greenhouse conditions [details of which are given, the results being tabulated and discussed] *D. macrospora* was isolated from diseased iris plants, sometimes in association with a species of *Macrosporium* [cf. ibid., iv, p. 707], inoculations with each of which gave positive results. The spots caused by the *Macrosporium* were larger than those due to *D. macrospora* and the spores also germinated some days earlier.

It was ascertained experimentally that the waxy coating of the leaves of the iris retards the penetration of the fungus; field infections may thus be facilitated by heavy rain or the constant rubbing of the leaves.

The 'beardless' varieties appear to be immune from leaf spot when exposed to natural infection, though the Dorothea K. Williamson beardless variety was susceptible when a large quantity of inoculum was inserted with a needle into the leaves, the resulting fungal growth being, however, very slow. On this variety the *Macrosporium* was much more virulent than *D. macrospora*.

Narcissus plants were not found to be susceptible to *D. macrospora*.

The spores of the Quebec organism measured 30 to 88 by 12 to

28 μ, and 7-septate spores were twice noted, indicating that it may be a different strain from that studied in other countries.

The paper terminates with a list showing the degree of susceptibility to leaf spot of numerous varieties of iris.

JONES (F. R.). **Development of the bacteria causing wilt in the Alfalfa plant as influenced by growth and winter injury.**—*Journ. Agric. Res.*, xxxvii, 9, pp. 545–569, 10 figs., 1928.

A detailed description is given of the author's study of the development of *Aplanobacter insidiosum*, the causal organism of bacterial wilt of lucerne [*R.A.M.*, vii, p. 786], in the host tissues at different stages of the disease, in an attempt to elucidate the connexion previously noted between the latter and winter injury to the plants [ibid., viii, p. 110]. The characteristic yellow discoloration of the root wood was found to extend far beyond the area of actual invasion by the bacteria; it is partly due to a yellow, insoluble, gum-like substance which appears to be a product of the plant, and partly to a relatively soluble yellow stain which may diffuse for some distance from the infected region. The discoloration is not conspicuously present in diseased stems, for which reason the extent and importance of phloem invasion in causing the death of plants was not recognized in earlier studies. So far as is known, the infection of the plant by the bacteria occurs exclusively through wounds in the roots or the crown stems, which expose the phloem parenchyma; from there, the bacteria pass readily between the cells of the phloem rays, ray cambium, wood rays, and wood parenchyma and into the vessels. In the latter they are carried by water for long distances. In parenchymatous tissues intracellular invasion only occurs when the cells are nearly fully developed, although occasionally the cells are broken down with the formation of bacterial pockets. Tissues formed during summer, especially summer wood, appear to be relatively resistant to invasion at all times. Bacteria were found high up the stem of flowering plants, and in one case in the base of a seed pod, but not, so far, in the seed.

At least 75 per cent. of the attacked plants appear to be infected in the spring, and most of them exhibit conspicuous symptoms of the wilt and die in the second year. The prevalence of spring infections is apparently due to the entrance of the bacteria through winter injuries, the organisms coming largely from old diseased plants, especially from the bases of shoots produced in the autumn. When these are killed by frosts, the bacteria are released into the surface water and are thus carried to other plants. This would indicate that outbreaks of the wilt may be greatly delayed or avoided by sowing new fields of lucerne in places where they are out of reach of surface water coming from infected fields.

VLADIMIRSKAYA (NADINE N.). **К биологии Epichloë typhina Tul.** [Contribution to the biology of *Epichloe typhina* Tul.]—*La Défense des Plantes*, Leningrad, v, 3–4, pp. 335–347, 2 pl., 5 figs., 1928.

The investigation reported in some detail in this paper was carried out in 1927 in the neighbourhood of Leningrad, and had

for its main object the study of the biology of *Epichloe typhina*. Locally the fungus is widespread on pasture grasses, especially on *Dactylis glomerata* (which was used in the experiments described), and seldom attacks cereals. In 1921 it was, however, recorded on wheat in the government of Novgorod, and in 1923 and 1924 was reported as severely attacking rye in the government of Viatka. A list is given of all the species of Gramineae so far known to be attacked by the fungus.

Under local conditions, the vegetative cycle of *E. typhina* is completed in the course of $2\frac{1}{2}$ to 3 months, while during the rest of the year it remains dormant in the form of mycelium in the tissues of the host. The first manifestation of infection is the appearance on the host leaves (in 1927 as late as the first days of June, owing to the exceptionally cold spring of that year) of a delicate mycelial weft which rapidly thickens and assumes a brilliant white colour; the stroma thus formed consists of thickly interwoven hyphae bearing emergent conidiophores and conidia. This stage lasts about one month, when the stromata gradually become yellow and begin to form perithecia. The latter take about two weeks to reach maturity. The fact that in the laboratory the ascospores germinated readily and produced secondary conidia on agar-agar and malt extract gelatine in a saturated atmosphere, together with the observation that the great majority of the ascospores ejected from the perithecia in still air dropped to the base of the plants, would indicate that these organs do not play any part in the overwintering of the fungus. It is believed, rather, that the ascospores formed during summer infect the tillering buds of the hosts, in which they form a dormant mycelium, which, in its turn, ensures the primary infection of the plants in the following spring [cf. *R.A.M.*, vii, p. 327]. To test this hypothesis, a number of plants of *D. glomerata* were artificially infected in their tillering buds with ascospores and secondary conidia of the fungus, but at the time of writing this report the results of these infections had not yet been established. Sections through some of the tillers produced by the infected buds showed, however, the presence in them of a mycelium.

E. typhina grows well in pure culture on certain natural and synthetic media, such as potato, rice, wheat ears, agar-agar, and malt extract gelatine; on the last two media it went through the whole of its development cycle, up to the production of perithecia, but no asci or ascospores were formed. On rice, potato, and wheat ears only the conidial stage developed. The minimum temperature for growth was between 2° and 9° C., with an optimum at between 16° and 19°. The maximum temperature was not established.

In the neighbourhood of Leningrad the stromata of *E. typhina* were found to be frequently parasitized by the larva of an undetermined species of fly, and such stromata usually failed to produce perithecia. Stromata held over winter on their host leaves under natural conditions did not retain their viability to the following spring. For the most part they were found to be heavily infested with species of *Fusarium* and *Cladosporium herbarum*, the latter of which developed luxuriantly on platings from them.

DICKSON (B. T.). **A peculiar winter injury to turf.**—*Nineteenth Ann. Rept. Quebec Soc. Protect. Plants*, pp. 49–51, 4 figs., 1927. [Received December, 1928.]

Golf courses at widely separated points in Quebec suffer from an injury to the turf in the spring due to the action of a fungus which grows rapidly in hollow places when the snow is melting, and forms a weft of greyish mycelium which quickly kills the grass. Later, the dead leaves and the mycelium dry up, leaving bleached dead areas, frequently circular and several inches in diameter, though much larger patches may be affected. In the latter case the injury may spread up the slopes, and in these better drained positions the grass may not be killed, as the fungus apparently dries up soon after killing the leaves while the collar and roots remain alive.

The fungus develops great numbers of pale amber, then almost black, sclerotia about $\frac{1}{3}$ mm. in diameter, in the killed patches of turf. They have a thin outer layer of cells with thickened brown outer walls, and are colourless inside. They germinate with difficulty and produce a mycelium which grows with some readiness in a refrigerator, developing numerous large clamp-connexions, followed by the formation of sclerotia on and under the surface of the medium.

Further investigations regarding the identity of the fungus are in progress.

ROSEN (H. R.). **The relationship of different species of pomaceous hosts to the over-wintering of the fireblight germ.**—*Fortieth Ann. Rept. Arkansas Agric. Exper. Stat. for the fiscal year ending June 30, 1928*, pp. 68–70, 1 fig., 1928.

Further investigations conducted at Fayetteville, Arkansas, into the relationship of different pomaceous hosts to the overwintering of the fireblight organism [*Bacillus amylovorus*: *R.A.M.*, vii, p. 227] showed that infections may occur through the stomata of sepals and petals, in which bacteria were found to be present when absent from the ovaries, including the parts containing the nectaries; this indicates that an additional spray applied between the cluster bud and calyx sprays should materially reduce blossom infection.

When a suspension of *B. amylovorus* in water was sprayed on young pear leaves in the greenhouse, marked symptoms of the disease appeared within 48 hours as a result of stomatal infection.

It was also ascertained that certain [unnamed] apple varieties frequently carried the causal organism over to the following season. Some varieties of pears, particularly Kieffer, are, however, still more dangerous to adjoining apple orchards, because of the rapidity with which they blight and the quantity of inoculum they produce.

Daily observations from March to May during three seasons showed that active cankers on the large limbs and trunks of apple trees were relatively rare. The overwintering of *B. amylovorus* on apple chiefly occurs on very small twigs and limbs. Bacterial oozing was not found in early spring from previously blighted or 'hold-over' cankers; if oozing occurred before the first signs of

newly developed blight, it was generated within freshly infected tissues, such fresh infections being extensions of previous lesions from which the organism extended within the tissues into the sound parts adjoining, e.g., into a leaf or flower cluster [cf. ibid., viii, p. 249].

BLATTNÝ (C.). **Padlím Jabloňovým (Podosphaera leucotricha Salm.) vyvolané chorobné změny.** [Pathological alterations caused by Apple mildew (*Podosphaera leucotricha* Salm.).]—*Ochrana Rostlin*, viii, 4, pp. 91–93, 1 fig., 1928.

Apple mildew (*Podosphaera leucotricha*) is stated to have been very troublesome in 1928 in all apple-growing regions of Czecho-Slovakia, following an exceptionally late and cold spring. The noticeable feature of this outbreak was that it came after an almost entire absence of the disease in 1927, this suggesting that the fungus had been carried over in a latent condition from 1926, when epidemics were general and severe owing to the weather conditions then prevailing. Besides the witches' brooms caused by the fungus recently recorded on Pippin grafts by Baudyš [see above, p. 289], the disease severely attacked the leaves, petioles, and flowers of the White Astrakhan variety in southern Bohemia. The flowers were either killed while still in the bud, or, when they developed, their pistils and stamens were deformed, and the anthers did not form any pollen. Conidia of the fungus abundantly covered the pedicels and calyx, but were not seen on the other floral organs.

In the author's opinion, these two new forms of the disease mark an intensification in the parasitism of the fungus, and call for energetic control measures.

ERNI (W.). **Versuche über Verschiebung der ersten Bespritzung nach Blütenblattfall, insbesondere im Hinblick auf die Bekämpfung des Schorfes, der Schrotschusskrankheit und der tierischen Schädlinge.** [Experiments on the postponement of the first spray until after petal fall, especially with reference to the control of scab, shot hole, and insect pests.]—*Schweiz. Zeitschr. für Obst- und Weinbau*, xxxvii, 26, pp. 463–469, 6 figs., 1928.

The results of experiments [details of which were presented at the fifth conference on the control of fruit diseases at the Wädenswil (Switzerland) Fruit Growing Institute] showed that spraying against apple scab [*Venturia inaequalis*] and insect pests can safely be postponed until shortly after petal fall in well-cultivated orchards. On the other hand, cherry trees which have received no dormant spray against shot hole [*Clasterosporium carpophilum*] should be given the first summer application before the opening of the petals.

OSTERWALDER (A.). **Die Verwendung 5%iger Schwefelkalkbrühe (1:20) bei der Schorfbekämpfung im Sommer.—Günstige Wirkungen gegen den Schorf von Bespritzungen mit Schwefelkalkbrühe bei Knospenaufbruch oder vor dem Oeffnen der**

Blüten. [The use of 5 per cent. lime-sulphur (1 in 20) solution for scab control in summer.—Favourable action on scab of applications of lime-sulphur solution at the bursting of the buds or before the opening of the flowers.]—*Schweiz. Zeitschr. für Obst- und Weinbau*, xxxvii, 26, pp. 469–473, 1928.

The results of experiments in the control of apple scab [*Venturia inaequalis*] were not found to justify the use of a 5 per cent. solution of lime-sulphur in preference to the standard strength (1 in 30 or 1 in 40). Preliminary tests indicated the value of early applications—at the bursting of the buds or just before the flowers open—in the control of this disease [but see preceding abstract].

ERNI (W.). **Versuche über Spätsommerbehandlung empfindlicher Apfelsorten.** [Experiments on the late summer treatment of susceptible Apple varieties.]—*Schweiz. Zeitschr. für Obst- und Weinbau*, xxxvii, 26, pp. 473–474, 1 fig., 1928.

The results of experiments conducted during the current and previous seasons indicate that a third application of lime-sulphur, in the beginning or middle of September, is essential for the control of scab [*Venturia inaequalis*] on susceptible, late ripening varieties, e. g., Boiken, Beauty of Boskoop, and Baumann's and Landsberg Pippins.

OSTERWALDER (A.). **Schorfbekämpfungsversuche mit Schwefelkalkbrühe und verschiedenen Zusätzen.** [Scab control experiments with lime-sulphur solution and various admixtures.]—*Schweiz. Zeitschr. für Obst- und Weinbau*, xxxvi, 26, pp. 446–454, 1928.

At the fifth conference on the control of fruit diseases at the Wädenswil (Switzerland) Fruit Growing Institute [cf. *R.A.M.*, vii, p. 381], the author stated that no improvement in the efficacy or adhesiveness of 1 in 40 lime-sulphur solution, used for the control of apple scab [*Venturia inaequalis*], was obtained by the addition of copper sulphate, kukaka [ibid., vii, p. 698], iron sulphate, gelatine, or sour milk.

ERNI (W.). **Versuche zur Verbesserung der Schwefelkalkbrühe.** [Experiments in the improvement of lime-sulphur mixture.]—*Schweiz. Zeitschr. für Obst- und Weinbau*, xxxvii, 26, pp. 454–455, 1928.

The efficacy of a 2·5 per cent. lime-sulphur (Maag) mixture, with and without the addition of 0·25 per cent. iron sulphate, 0·5 per cent. Bordeaux mixture, or 1 per cent. skim milk, was tested against apple scab [*Venturia inaequalis*] and other fruit parasites in Switzerland. With the possible exception of iron sulphate, the adhesive substances proved valueless in augmenting the efficiency of the standard lime-sulphur mixture [see preceding abstract]. The addition of skim milk further resulted in the scorching of susceptible varieties.

MAAG (R.). **Untersuchungen über Winter- und Sommerbespritzung im Heimgarten Bülach 1928.** [Investigations on winter and summer spraying at Heimgarten Bülach 1928.]—*Schweiz. Zeitschr. für Obst- und Weinbau*, xxxvii, 26, pp. 498–510, 3 figs., 3 graphs, 1928.

A series of experiments [details of which are given] was carried out to determine the relative efficacy of various standard winter and summer treatments in the control of apple scab [*Venturia inaequalis*] and other pests and diseases in Switzerland. The best dormant spray was found to be a 15 to 20 per cent. lime-sulphur solution (Maag) with the admixture of 1 per cent. iron sulphate, applied at the end of February. The most effective of the summer sprays was 5 per cent. lime-sulphur with 2 per cent. lead arsenate, applied once before the opening of the flowers and twice to four times afterwards.

SPERGER (R.). **Beobachtungen über die Wirksamkeit von Spritzmitteln gegen den Schorf und die Obstmade.** [Observations on the efficacy of sprays against scab and the fruit maggot.]—*Schweiz. Zeitschr. für Obst- und Weinbau*, xxxvii, 26, pp. 511–512, 1928.

Apple scab [*Venturia inaequalis*] was well controlled on the Cassel and Landsberg Pippins and Golden Pearmain varieties in the writer's orchard [in Switzerland] by five applications of (*a*) lime-sulphur solution [strength not specified], (*b*) 2·5 per cent. Bordeaux mixture, or (*c*) a 1 per cent. colloidal copper-lime mixture. Lead arsenate (2·5 per cent.) was added to each of these preparations at the second and third application. The Cassel Pippins treated with lime-sulphur were severely defoliated by a leaf-spot disease which did not attack the trees receiving the cupric treatments.

FERRARIS (T.). **Necrosi corticale del Pero.** [Cortical necrosis of Pear.]—*Rivista Agricola*, xxiv, 554, pp. 563–564, 4 figs., 1928.

In February, 1927, the author received from Dalmatia [Jugo-Slavia] pear branches showing unilateral, somewhat depressed, reddish, smooth, cortical lesions, 6 to 15 cm. long, bounded by a dark edge raised somewhat above the healthy bark. In the centre of the lesions was a blackish area, sometimes surrounding an open wound caused by the falling of a withered shoot, and containing numerous, sparse, subepidermal, erumpent stromata covered by the split periderm. The stromata were black at the apex, without prominent ostioles, reddish brown internally, and towards the base showed loculi orange-coloured at the periphery and with the cavity bounded by a thick layer of filiform, hyaline basidia bearing numerous curved, hyaline, continuous spores, rounded at the extremities and measuring 4 to 4·5 by 1 to 1·5 μ. This organism, which is considered to be the cause of the cankers, is identified as *Cytospora microspora*.

Control should consist in removing the affected branches and giving winter applications of 3 to 4 per cent. copper mixtures.

VEDENEYEVA (Mme Z. S.). О грибной болезни—,,пятнистости''—косточковых плодовых пород в Средней Азии. (**Clasterosporium carpophilum Aderhold**). [On a fungal disease—'spotting'—of stone fruit trees in Central Asia (*Clasterosporium carpophilum* Aderhold).]—Issued by *Узбекистанская Опытная Станция Защиты Растений* [*Uzbekistan Exper. Plant Prot. Stat.*], Tashkent, *1928*, 10, 21 pp., 8 figs., 5 graphs, 1928.

This is a semi-popular account of the morphology and biology of *Clasterosporium carpophilum* [*R.A.M.*, vii, p. 730], which is stated to be extremely prevalent in all the fruit-growing districts of Russian Central Asia. It attacks all species of stone-fruit trees, but the greatest amount of damage is caused to apricots, which are extensively exported after drying. The annual loss in this crop alone is conservatively estimated at one million and a half of roubles [over £150,000]. All the varieties of apricots grown in the region in question are equally subject to attack by the fungus, but the indications are that the local, sweet varieties are more susceptible than those with more acid fruits, the same also being true of cherries. A remarkable feature was the discovery in 1925 of well-defined fructifications of the fungus on the leaves of pear, and in 1927 on the leaves of apple trees growing in close proximity to heavily infected peaches, plums, and apricots, and it is believed that the spotting of pear and apple fruit noticed in those years is also attributable to this organism.

Under local conditions, as indicated by numerous experiments, the best control of the disease is afforded by two sprayings with 1 per cent. Bordeaux mixture, which consistently gave 80 per cent. of clean fruit (in a few cases even 93), while controls showed the same percentage of unmarketable fruit. Spraying with copper sulphate, copper carbonate, and lime-sulphur did not prove satisfactory.

All the figures illustrating this paper are original.

DURUZ (W. P.). **Coryneum of Apricots and its control.**—*Proc. Amer. Soc. Hort. Sci., 1927*, pp. 176–179, 1928.

The results of four years' experiments [the data of which are tabulated and discussed] showed that *Coryneum beijerinckii* [*Clasterosporium carpophilum*: see preceding abstract] may be satisfactorily controlled in California by three applications of Bordeaux mixture as follows: (1) just before or soon after the first autumn rains (5–5–50); (2) as the buds are swelling or the petals just showing in the spring (same strength); and (3) immediately after the husks (old calyces) have dropped from the young fruits. The last spray gives protection against the heavy infection which is liable to occur after the late spring rains in April and May.

DURUZ (W. P.). & GOLDSWORTHY (M. C.). **Spraying for Peach rust (a progress report).**—*Proc. Amer. Soc. Hort. Sci., 1927*, pp. 168–171, 1928.

During 1926 and 1927 the writers conducted a series of experiments in the control of peach rust (*Tranzschelia punctata*) [*Puccinia pruni-spinosae*], which caused heavy damage (estimated at

over $300,000) in the Sacramento Valley, California, in the former season. The disease is carried over the winter on the one-year-old twigs, from which it spreads to the leaves early in the summer and then to the fruit. It chiefly affects the so-called midsummer varieties, such as Paloro, Peak, Hauss, Gaume, Johnson, Walton, Libbee, and Sims. It was found that liquid lime-sulphur (1 per cent.), applied at the pink stage and again in the early summer gave very effective control, reducing the incidence of infection on the fruit (the most serious phase of the disease) from over 98 to below 10 per cent. A number of standard fungicides, as well as some less well-known preparations [which are enumerated], gave promising results in the prevention of spring infection, but further observations are necessary before a final decision as to their respective merits can be reached.

BROOKS (C.) & COOLEY (J. S.). **Time-temperature relations in different types of Peach-rot infection.**—*Journ. Agric. Res.*, xxxvii, 9, pp. 507–543, 30 graphs, 1928.

The purpose of this investigation, made in continuation of the authors' study of stone fruit rots [*R.A.M.*, i, p. 347], was to determine the effect of varying temperatures on the incubation and further development of the transit rots of peaches caused by the *Monilia* stage of *Sclerotinia fructicola* [*S. americana*: ibid., viii, p. 253] and *Rhizopus nigricans*, and also the bearing of the mode of infection on the incidence and progress of the rots. Experiments were also made to establish the behaviour of the rots in a gradually falling temperature, such as prevails in refrigerator cars, and an attempt was made to equate the different temperature values and the values obtained for the incubation and growth of the rots. The increase in diameter of the rot was adopted as a standard of comparison, as experiments established that both rots showed an approximately uniform increase in diameter in the different stages of development, and neither the surface area, nor the volume of the rot, nor the weight of the decayed tissue, proved to be a satisfactory basis for temperature comparisons. The temperatures tested ranged from 0° to 30° C.

The results showed that low temperatures had a relatively greater effect in inhibiting the development of both *Monilia* and *Rhizopus* rots during the incubation period than during later growth. A change in temperature of 5° exerted a greater influence on the incubation and subsequent growth of the rots at the lower than at the higher temperatures. *Rhizopus* was much more responsive to temperature variations than *Monilia*. In regard to the mode of infection, the incubation period for both organisms was about twice as long with peaches that were first punctured and then dusted with spores as in needle inoculation tests; with *Monilia*, the incubation was still longer and the infections less than a quarter as numerous when the spores were dusted over apparently sound peaches, while *Rhizopus* appeared to be unable to penetrate the sound skin of market-ripe fruit. All the *Monilia* rots induced by needle punctures started practically together, while on peaches dusted with spores after puncturing infections

continued to appear over a long period of time, and this also occurred with *Rhizopus* in both types of inoculation.

In experiments duplicating the temperature conditions in refrigerator cars, and in standard cars under commercial shipping conditions, the effect of the different temperatures prevailing at the top and at the bottom of the car was evidenced by the number of resulting infections rather than by the average size of the rots produced, the same being also true of delayed as compared to immediate cooling of the car. This was apparently due to a retardation and spreading out of the infection period resulting from the lower temperatures and the more rapid cooling. In the production of *Monilia* rots the temperatures at the top of the car had about 2·5 times the rotting value, as estimated by the percentage of work accomplished per hour, of those at the bottom; about 60 per cent. of this difference, and 60 per cent. of the growth value in both the top and bottom of the car were developed during the first 36 hours after the closing of the car. Infections from needle inoculations with *Monilia* appeared from 17 to 65 (average 42·5) hours earlier at the top than at the bottom. Punctured peaches, dusted with *Monilia* spores 1 to 6 hours before loading, developed about 50 times as many infections at the top as at the bottom, and about four times as many when similarly treated 14 to 21 hours previous to loading.

Apparently sound peaches from trees that had not been sprayed during the vegetative period developed about four times as many infections in transit as similar peaches from sprayed trees, this showing that the value of orchard spraying does not end in the orchard, but is manifest on the fruit to its final destination.

GLOYER (W. O.) & GLASGOW (H.). **Defoliation of Cherry trees in relation to winter injury.**—*New York (Geneva) Agric. Exper. Stat. Bull.* 555, 27 pp., 8 figs., 1928.

In 1928 the Montmorency cherry trees of western New York differed greatly in the amount of defoliation caused either by a physiological disease known as yellow leaf or by the leaf spot fungus *Coccomyces hiemalis*. In general, the most vigorous trees suffered least from leaf fall. Winter injury appeared to be the primary cause of the lack of vigour of certain trees. Where the leaf spot was held in check by timely disinfection of the trees with lime-sulphur (early in June), a close correlation was observed between defoliation due to yellow leaf and winter injury of the roots. The condition known as small cherry [*R.A.M.*, viii, p. 45], which is known to result from the excessive use of lead arsenate, was also found to be caused at times by attacks of *C. hiemalis* on the fruit stalks. In other cases both leaf spot and yellow leaf were found associated on the same tree. In 1928, winter injury of the roots was connected with a severe outbreak of leaf spot, while the winter killing of the branches in 1917–18 is attributed to the insufficient supply of stored food material resulting from previous defoliation. The possible reduction of this form of damage by means of cultural measures is discussed.

FERRARIS (T.). **Mummificazione delle Nespole.** [Mummification of Medlars.]—*Curiamo le Piante!*, xxiii, 12, pp. 234–236, 2 figs. [1 on cover], 1928.

Mummification of medlar fruits (*Mespilus germanica*) induced by *Sclerotinia fructigena* [cf. *R.A.M.*, i, p. 432; iii, p. 370] not infrequently affects 50 per cent. of the crops locally in Italy. The fungus infects the young fruits soon after the fall of the corolla, the mycelium penetrating the pulp, which becomes hard and insipid. In autumn the fruit becomes covered with the conidial cushions, which live over the winter and serve as a source for fresh infection the following spring.

Affected fruits should be destroyed in winter, and after thorough pruning in February, two applications of Bordeaux mixture or 3 to 4 per cent. Caffaro paste should be given, followed immediately after flowering by another with 1 per cent. Caffaro powder and a final application one month later.

GARD (M.). **Sur les causes de l'infécondité des Noyers et de la Vigne en 1926.** [On the causes of the unproductiveness of Walnut trees and the Vine in 1926.]—*Ann. des Epiphyties*, xiv, 2, pp. 132–162, 5 figs., 4 charts, 1928.

After discussing the unusual weather conditions which prevailed during the early part of the season of 1926, which was exceptionally cold and wet, and their effects on the growth of vines and walnut trees (*Juglans* spp.) in south-western France, the author describes the incidence of diseases on the latter host during this period.

Anthracnose (*Marssonia* [*Marssonina*] *juglandis*) [*Gnomonia leptostyla*: *R.A.M.*, v, p. 331] was of unprecedented severity, defoliating the trees of their first leaves by the end of May, and also affecting the branches and young fruits and causing shedding of the latter, many of which bore blackish lesions due to the fungus. Contamination is periodic, occurring when rains have made the trees receptive; the leaves which appeared after the end of May, though slightly affected, did not fall.

The most susceptible varieties are *J. californica* and *J. hindsii*, some of which were killed; *J. regia* and *J. cinerea* are less so; *J. sieboldiana*, *J. cordiformis*, and *J. sinensis* are very resistant; while *Carya* and *Pterocarya* spp. are practically immune. The optimum atmospheric conditions for the development of the disease are a temperature of about 10° C. and a high relative humidity (70 per cent. or over).

Encouraging results in arresting defoliation were given by applications of Bordeaux mixture with arsenic.

Microstroma juglandis [ibid., vii, pp. 406, 407], usually found only on nursery stock in south-western France, was also much more prevalent in 1926 than in normal years. At Bordeaux some 6- to 7-year-old walnuts from the Far East were severely affected, and some of the older *J. regia* trees were also attacked.

LEE (H. A.) & MARTIN (J. P.). **Oxidizing agents in sulphur to increase fungicidal activity.**—*Phytopath.*, xviii, 12, pp. 1026–1027, 1928.

Attention is drawn to the fact that Bailey's and Greaney's favourable results with oxidized sulphur in the control of stem rust of wheat [*Puccinia graminis*: *R.A.M.*, vii, p. 565] confirm the writers' conclusions as to the efficacy of this preparation against eye spot of sugar-cane (*Helminthosporium*) [*sacchari*: ibid., viii, p. 134]. It is very important that exact counts should be made of the incidence of infection on the various plots, since experience has shown that comparisons on the basis of mere visual observation are most misleading where the differences in the degree of infection are below 33 per cent.

HANNA (W. F.). **A simple apparatus for isolating single spores.** —*Phytopath.*, xviii, 12, pp. 1017–1021, 1 fig., 2 diags., 1928.

The writer gives technical details of the construction and application of a simple apparatus specially designed for the isolation of single spores by Dickinson's method [*R.A.M.*, v, p. 377].

BRANDENBURG (E.). **Ueber Mosaikkrankheiten an Compositen.** [On mosaic diseases of Compositae.]—*Forsch. auf. dem Gebiet der Pflanzenkrankh. u. der Immunität in Pflanzenreich*, v, pp. 39–72, 24 figs., 1928.

In 1926 a pathological and cytological study was made of the mosaic disease of lettuce (*Lactuca sativa* var. *capitata*) and dahlia (*Dahlia variabilis*) at Bonn.

It is not apparent from Jagger's brief description of lettuce mosaic (*Journ. Agric. Res.*, xx, 1921) whether the symptoms of the disease in America correspond with those observed in Germany, where two distinct types of the disturbance may be recognized, viz., leaf vein and dot mosaic [cf. *R.A.M.*, vii, p. 134]. In the former type the veins of the youngest leaves appear abnormally broad owing to their pallor and that of the tissues immediately bounding them. The transition from the pallid veins to the normal rich green intercostal areas is somewhat abrupt. The surface growth of the affected areas is retarded, with the result that the intercostal regions arch upwards, giving the leaves a more or less crinkled appearance, which is further accentuated by a shortening of the midrib. In fully grown diseased leaves the pale colour is almost confined to the veins, owing to the gradual development of chlorophyll in the neighbouring spongy parenchyma. Heading is retarded by eight to ten days, the heart leaves clustering together in the form of a rather loose rosette. After 'bolting', the discoloration described above reappears on the leaves of the seed-bearers, but there is no crinkling and in some cases the symptoms gradually fade away.

In dot mosaic, pale or white, sharply defined spots are scattered irregularly over the youngest leaves (chiefly their upper halves). In more advanced stages these spots often assume a necrotic, greyish-brown appearance. The severity of the symptoms of this type of mosaic varies greatly. In some plants the leaves show only a few isolated spots, while in others these are sprinkled over the

entire surface. Sometimes the leaves are very crumpled and stunted. Heading is much delayed or may be altogether prevented. The seed-bearers show a pale green to yellowish discoloration of the leaf margin and severe necrosis of the lamina, which may be entirely destroyed. The bracts and the main and lateral stems also develop necrotic lesions similar to those of potato streak [ibid., ii, p. 286]. Heavily infected plants do not flower. The upper leaves of the diseased seed-bearers are abnormally small, wavy or crinkled, and round instead of lanceolate. The numerous lateral shoots are more compact and erect than those of normal plants.

The young leaves of mosaic dahlia plants show an irregular pale discoloration, especially near the main and lateral veins, but later the normal tint develops. The affected leaves, however, are smaller and narrower than normal ones, and are frequently deformed, while in the Paradiesvogel variety the number of flowers is reduced and their colour changed from crimson to brick-red with pale longitudinal stripes.

A series of experiments [the technique of which is indicated] was conducted to determine the mode of transmission of the various types of mosaic discussed in this paper. Leaf vein mosaic of lettuce was found to be transmitted almost exclusively by the seed, and it is considered very doubtful whether this condition represents a genuine mosaic. The disease occurs during April, before the advent of the aphids, and all attempts to transmit it by means of *Macrosiphum hieracii* in May gave negative results. On the other hand, dot mosaic of lettuce was successfully transmitted by *M. hieracii* as well as through the seed (8 to 10 per cent. infection in the latter case) [ibid., ii, p. 432]. Using the former method of transmission, the symptoms of the disease did not appear until after bolting on plants inoculated in May, showing that in Germany the incubation period is evidently longer than that recorded by Jagger in the United States. Attention is drawn to the importance of the early removal of diseased seed-bearers.

The natural perpetuation of mosaic in dahlias is ensured by the persistence of the virus in the root-stock and tubers, so that the new shoots are already diseased when they appear. The condition is apparently not transmissible by aphids (only *Mycoides persicae* was used in these tests) or by the direct transference of expressed juice from diseased to healthy plants. Successful results were obtained, however, by grafting healthy scions on diseased stocks and vice versa. Dahlia mosaic was not transmissible to lettuce.

A cytological examination [full details of which are given] was made of mosaic and healthy lettuce and dahlia plants. Isolated phloem cells of diseased dahlia plants were found to contain one or more wavy or corkscrew-shaped bodies, generally situated near the sieve-plates [cf. ibid., vii, p. 797]. Five distinct types of body may be differentiated, namely, (1) very thin, sinuous filaments with two to four flat, irregular curves, tapering at both ends and measuring 5 to 10 by 0·3 to 0·7 μ; as many as ten of these may occur in one cell, but as a rule the larger, corkscrew- or U-shaped, elongated bodies (10 to 25 by 1 to 2·5 μ) are found singly. Sometimes these bodies are bright red and are partially or wholly enveloped in a

delicate, faintly tinted plasma-like substance. (2) This group comprises bodies differing from the above in the coils occurring in the middle or at one end. (3) To the third group belong fusiform, elliptical, or oblong bodies, measuring 10 to 20 by 3 to 4·5 μ, with undulating edges, small constrictions, and marked transverse striation. (4) The fourth group is represented by S-shaped bodies, the interior of which is often composed of numerous slender filaments, which may sometimes project from the enclosing sheath or even be liberated into the cell cavity. (5) This group comprises spherical or oval bodies measuring 10 to 20 by 6 to 10 μ and bright red, amorphous, compressed masses, frequently occupying the same cells with 12 to 15 of the smallest bodies belonging to group (1).

The bodies found in the phloem cells of mosaic lettuce plants are similar to those described above, but whereas in dahlia groups (2) to (5) predominate, in lettuce the corkscrew-shaped or wavy bodies are most common. The dimensions of the lettuce bodies, which were found before bolting in the leaves as well as in the stalks of the seed-bearers, range from 7 to 30 by 0·4 to 2 μ. In both hosts the cell nuclei are more or less disorganized by the presence of the inclusions. This is considered to indicate the possibility of parasitism on the part of these bodies, but no definite conclusion as to their rôle in the causation of mosaic disease is advanced as a result of the present studies.

NEILSON JONES (W.) & LLEWELLYN SMITH (M.). **On the fixation of atmospheric nitrogen by Phoma radicis callunae, including a new method for investigating nitrogen fixation in micro-organisms.**—*Brit. Journ. Exper. Biol.*, vi, 2, pp. 167–189, 1 pl., 1 diag., 1928.

Using a specially devised apparatus [full details of the construction and application of which are given], the writers conducted a series of experiments in the growth of the mycorrhizal fungus of *Calluna*, *Phoma radicis callunae*, on a nitrogen-free medium with and without a supply of molecular nitrogen [*R.A.M.*, iv, pp. 366, 428]. The results of the tests [which are tabulated and discussed] indicate that the amount of glucose used by the fungus during growth, and the quantity of nitrogen contained in the culture at the end of the growth period are greater under the former condition. It is concluded that the fungus is capable of utilizing the molecular nitrogen of the air to a certain extent.

YUILL (J. L.). **Alcoholic fermentation by Aspergillus flavus Brefeld.**—*Biochem. Journ.*, xxii, 6, pp. 1504–1507, 1928.

Brief details are given of experiments which showed that, in the presence of chalk and in a culture medium containing 12 to 15 per cent. sucrose, *Aspergillus flavus* produces large quantities of ethyl alcohol, even when no precautions are taken to exclude air from the cultures. In one series of cultures, the alcohol produced amounted to 2 or 3 per cent. of the liquid medium, and represented 15 to 20 per cent., by weight, of the sugar consumed. During fermentation considerable quantities of chalk are dissolved, some

cipitated by the alcohol. It was noted, however, that when the fungus formed spores, the yield of alcohol was much reduced and the quantity of citrate was increased.

Under similar culture conditions, *A. oryzae* did not produce any alcohol.

BLOCHWITZ (A.). **Farbenänderung, Verschiedenfarbigkeit und Farbenvariation bei Schimmelpilzen.** [Metachromia, heterochromia, and colour variation in moulds.]—*Ber. Deutsch. Bot. Gesellsch.*, xlvi, 7, pp. 516–524, 1928.

Since 1906 the author has studied the phenomena of metachromia (colour change) and heterochromia (colour difference) in moulds, chiefly of the genus *Aspergillus* [*R.A.M.*, v, p. 701].

The results of culture experiments with some fifty strains of *Aspergillus*, including the species *A. oryzae*, *A. flavus*, *A. versicolor*, *A. varians*, *A. atropurpureus*, *A. japonicus*, *A. violaceo-fuscus*, *A. nidulans*, *A. flavus-oryzae*, and *A. tamarii*, showed that the membrane and contents of the conidia may vary in colour in one and the same species. The general tone of the membrane is yellow, later brown, and the protoplasm green or bluish. The wall shows a paler colour in acids than in alkaline media.

The brown coloration of old cultures may be partly due to changes in the reaction of the medium, as well as to the increase of pigment. These conditions, however, do not explain the intensive colour variations in young conidia, which are assumed to be caused by the reaction to an acid medium of the so-called 'leucobase': where this is absent no green coloration can be induced by acidity. Thus both metachromia and heterochromia in the conidia depend on the fluctuating proportions of two pigments—or three, if the acid or alkaline combinations of the wall pigment be counted as different pigments.

Some strains of *A. flavus* are pure green, while others are brown. Thus, a Utrecht strain has completely lost its green pigment in the course of many generations and become pure brown.

The mycelium, too, often contains several pigments which vary with the reaction; this is the case, for instance, with *A. versicolor*. *A. glaucus* forms no less than four different mycelial pigments in varying proportions, viz., yellow, brick-red, brown, and purple. A strain of *A. glaucus* received from Japan and America forms only a yellow and vivid green pigment even in the conidiophores and conidia, and should, therefore, be raised to specific rank; for this form the author proposes the name *A. pseudoglaucus* [but without diagnosis]. *A. ustus* Thom [loc. cit.] is characterized by copper- to bronze-coloured primary conidia, fawn, grey, or green secondary conidia, and yellow hyphae, and thus affords an extreme example of heterochromia.

GÄUMANN (E.). **Das Problem der Immunität im Pflanzenreich.** [The problem of immunity in the plant world.]—*Viertel-jahrsschr. Naturforsch. Gesellsch. Zürich*, lxxiii, *Beibl.* 15, pp. 450–468, 1 fig., 2 graphs, 1928.

This is a discussion, in general terms, on the problem of immunity in the plant world, with special reference to various recent investigations which have already been noticed in this *Review*.

KOSTOFF (D.). **Acquired immunity in plants.**—*Genetics*, xiv, 1, pp. 37–77, 5 figs., 2 diags., 5 graphs, 1929.

The author claims to have established the production of antibodies in plants, by means of grafting between certain species and genera of the Solanaceae [which are enumerated and the experimental data tabulated and discussed]. Normal precipitins and lysins were found to occur in the plant extracts, which affected the extracts of other species. In grafting between these species a mutual induction of antibodies in scion and stock was found. Normally, *Nicotiana rusbya* plants were capable of little or no precipitin reaction when tested on normal *N. rustica* extract, but after grafting scions of the former on stocks of the latter, the grafted shoots developed a considerable precipitin reaction on *N. rustica*. This acquired (immune) precipitin reaction generally reached its maximum in 30 to 45 days, and was usually specific for the plants tested. Non-specific precipitins, however, were also found in some cases, while in others there was a decrease in precipitin reaction after grafting. Optimum temperatures for growth and strong light increased the precipitin content.

When *N. glauca* was grafted on *Capsicum pyramidale* the growth of the scion shoots ceased, and they began to die, after four or five weeks. Stocks of *C. pyramidale* on which five such scions had died could no longer be successfully grafted with *N. glauca*. This is attributed to the antibodies induced in the stock by the earlier graftings.

In some graft unions the mutual reaction between stock and scion is indicated by an agglutination of plastids in the cells on both sides of the graft union; this phenomenon was observed in chloroplasts in several cases.

TEHON (L. R.). **Methods and principles for interpreting the phenology of crop pests.**—*Illinois Dept. Registr. and Educ. Div. of Nat. Hist. Survey Bull.*, xvii, Art. 9, pp. 321–346, 6 maps, 12 graphs, 1928.

The method suggested in this paper for arriving at a graphic representation of the relationship existing between the distribution, extent, and intensity of outbreaks of plant diseases and insect pests, on the one side, and variations in climatic conditions (temperature and rainfall), on the other, is based on the use of special charts proposed by Ball about 1910 and first applied in practice by Taylor in 1916. These charts, termed hythergraphs, are in the form of graphic diagrams, the vertical and horizontal scales of which usually represent temperature and rainfall, respectively, and any combination in the measurements of these two factors is determined by the intersection of the corresponding ordinate and abscissa in the usual way. In its simpler form, a hythergraph thus consists of a series of points which mark combinations of temperature and rainfall for successive days or for longer periods, and it is often possible to show the general trend from one to another of these points by an ordinary graph of connecting lines. A more complicated form is constructed by plotting a considerable number of

mean temperature and total rainfall combinations for stated periods, such as months or years, or for determined localities or regions. By joining the plotted points with straight lines, it is then possible to determine the particular range of the climatic conditions associated with a given phenomenon [in the present case disease or insect outbreak] or with certain degrees of its manifestation, as indicated by correlative data. The result is usually one or several irregular polygons which may be rendered more inclusive, and probably more indicative, by 'smoothing' them by means of mathematical formulae or, when the data are sufficiently abundant, by the use of the draughtsman's 'French curve'. The resulting lines, called 'isopracts' by Huntington, are roughly circular, elliptical, or ovoid, and are usually eccentrically arranged. These two types of graphs may often be combined advantageously to show not only the ranges but also the trends of the two factors considered in the course of months, seasons, or any other desired period associated with the phenomenon studied. For the sake of brevity, the author suggests two new terms, namely, 'thermohyet' to designate the combined datum consisting of a record of temperature and rainfall and, by analogy, any point in the hythergraph representing this record; and 'thermohyetic' to serve as an adjective instead of the more unwieldy expressions 'temperature-rainfall', 'mean temperature—total rainfall', and the like.

The use of the hythergraphs is illustrated by their application to the study of the relationship to weather conditions of late blight of potatoes [*Phytophthora infestans*], of the beet leafhopper (*Eutettix tenella*) and curly top of sugar beet, and of the cucumber beetles (*Diabrotica vittata* and *D. duodecempunctata*) and bacterial wilt of melons (*Bacillus tracheiphilus*). The comparison of hythergraphs constructed on Martin's data for potato blight in New Jersey, where epidemics are relatively frequent, and for four northern stations of Illinois, where the disease occurs sometimes in mild epidemics but is usually absent, showed that the normal thermohyets for the latter, while outside the isopract for mild destructiveness of the blight in New Jersey, lie so close to the boundary that slight variations from the norm in temperature and rainfall during the critical period are sufficient to render the development of an epidemic not only possible but to be expected. In the case of curly top of sugar beet, the indications obtained by the use of these graphs are that the growing season of the plants is the period of most consequence in respect of the disease, whereas other periods of the year, more especially the hibernating period, are of greater significance in regard to the leaf-hopper carrying it. By way of further illustration, the author describes and discusses in detail a modification of the hythergraph as applied to the study of the correlation of the destructiveness index of wheat rust (*Puccinia triticina*) to the mean temperature and total rainfall in rust years in Illinois, no conclusion from which is, however, drawn. A new feature in this study is the attempt to represent this correlation in a three dimensional graph, in which the isopracts for destructiveness of the rust are used in the same way as contour lines are employed by physiographers to show differences in altitude on plane surface maps.

Blattný (C.). **Mezinárodni pokusy holandsko-československé o degeneraci Bramborové sádě v různých oblastech vlivem virusových chorob.** [International experiments in Holland and Czecho-Slovakia on the degeneration of Potato seed in different regions due to virus diseases.]—*Zemědělský Archiv*, Prague, xix, 5–6, pp. 327–330; 7–8, pp. 423–438, 1 fig., 1928.

The experiments described in this report were planned by the author in collaboration with Quanjer and Elze with the object of studying the effect of ecological factors in different regions on the development of virus diseases (with particular reference to crinkle and leaf roll) in the progeny of healthy potato seed. For this purpose 100 seed-tubers each (grown in Holland) of the early variety Schotsche Muis [Duke of York] and the late variety Industrie were quartered, two quarters being retained for sowing in Holland [where the experiments were conducted in 1925 on the lines of those previously reported upon by Quanjer and Elze; *R.A.M.*, iv, p. 436], while the remaining two were sent to Czecho-Slovakia, where they were planted in the same year in two localities differing greatly from one another in climatological and topographical characters, one being situated in northern and the other in central Bohemia. A source of infection was provided by interplanting four tubers of the Paul Kruger variety as bearers of leaf roll, and four tubers of the variety Bravo, as bearers of crinkle, and notes were periodically taken of the outbreak and spread of the diseases, as well as of all the insects present on the plants during the whole of the vegetative period.

From a summary of the results obtained in Holland and in Czecho-Slovakia [which are given in a comparative table] it is evident that in the low-lying plains of the latter country both diseases developed to a much greater extent and with greater intensity than in Holland, whereas in the highlands their incidence was entirely comparable with that in the latter country. This leads the author to the following conclusions. The altitude of the source of potato seed does not, as suggested hitherto [ibid., vii, p. 802], determine by itself the reliability of the seed from the point of view of degeneration, since healthy seed from the Dutch lowlands maintained itself in the Czecho-Moravian highlands. The deciding factor in the choice of seed is its testing and certification for freedom from virus diseases.

The main agents in the transmission and spread of the diseases are aphids, which are abundantly represented in the Czecho-Slovakian plains, such species as *Myzus persicae, Macrosiphum solanifolii* [*M. gei*], and *Aphis fabae* [*A. rumicis*] having been found in large numbers practically everywhere. Of hardly less importance in this respect is another insect (either *Chlorita* [*Empoasca*] *flavescens* or *Typhlocyba solani*: these two species are stated to be so closely related as to be practically indistinguishable from one another) which was very numerous and active in 1925. Preliminary experiments in 1924, although inconclusive, indicated that spraying the potato plants with insecticides may be of importance in the control of virus diseases, since treated lots produced considerably fewer small, degenerated tubers than the controls.

The main conclusion, however, is that the experiments have

again demonstrated that potato degeneration is chiefly, if not solely, due to virus diseases, and that experiments similar to those described in this paper, with careful noting of the insect fauna prevalent in various regions, are the only reliable means of determining localities where healthy seed may be grown with safety. It was demonstrated, with particular reference to local conditions, that the Czecho-Moravian highlands are well adapted for supplying healthy seed of late potato varieties.

GARDNER (M. W.) & KENDRICK (J. B.). **Potato mosaic and leaf roll: spread and effect on yield.**—*Trans. Indiana Hort. Soc.*, *1927*, pp. 158–168, 1928. [Received March, 1929.]

Field plot and greenhouse tests to determine the spread of potato mosaic and leaf roll and the effect of these diseases on yield were carried out at three localities in Indiana from 1924 to 1926. When the tuber progenies were indexed in the greenhouse, many hills were found to yield both healthy and mosaic tubers, or mosaic and leaf roll tubers, or a combination of the three conditions. In one locality the average yield of 7 Cobbler hills which contracted mosaic was 8 per cent. less than that of 45 healthy ones. Under the conditions of these experiments, current season infection with mild mosaic and streak not only caused no decline in yield but actually produced a slight increase in most cases. Mosaic in the three common Indiana varieties, viz. Rural, Ohio, and Cobbler, tends to develop into the very destructive streak type. Leaf roll was found to spread much more rapidly than mosaic. The use of leaf roll seed tubers caused a 17 to 75 per cent. reduction in yield, compared with 51 to 82 per cent. where mosaic tubers were used for seed.

BOTJES (J. O.). **Iets omtrent de beteekenis van enkele Aardappelziekten en vooral van het licht mozaiek bij verschillende rassen.** [Notes on the importance of certain Potato diseases and especially of mild mosaic in different varieties.]—Reprinted from *Landbouwkundig Tijdschr.*, xl, 483 (*Extranummer*), 6 pp., 1928.

In a series of experiments in the transmission of virus diseases of potatoes at Oostwold (Holland), apparently healthy Zeeuwsche Blaue tubers, grafted on to those of Eersteling [Duke of York], produced intensely severe symptoms of streak which rapidly killed the plants. A similar union between Zeeuwsche Blaue and Bravo tubers resulted in the development of symptoms resembling those of crinkle. Identical results were obtained with Duke of York and Bravo when Zeeuwsche Bonte or Bloemgraafje tubers were substituted for Zeeuwsche Blaue, but Eigenheimer and Roode Star showed no signs of infection from any of the three varieties that caused disease in the other kinds [cf. *R.A.M.*, vii, p. 801].

Mild mosaic produces conspicuous modifications in the Eigenheimer, Zeeuwsche Blaue, Bravo, and Duke of York varieties. In 1925 the yield of mild mosaic Eigenheimers in the writer's fields was 75 per cent. of that given by the healthy plots where Chile saltpetre was applied at the rate of 100 kg. per hect., the corresponding figures where 300 and 500 kg. of the fertilizer were

used being 80 and 87 per cent., respectively. Similar results were obtained in 1926. The Roode Star variety exhibits practically no external symptoms of mosaic, and its pale colour is commonly attributed to a bud variation rather than disease. However, on grafting the tubers of pale Roode Star plants on to those of Eigenheimer, the typical mosaic symptoms are obtained. Roode Star plants affected by mild mosaic tend to mature earlier and give higher yields than normal ones, and hence are frequently preferred by growers. The so-called 'Bonte' [variegated] Industrie is really an ordinary Industrie plant affected by mild mosaic, and when the tubers of such plants are grafted on to those of healthy Eigenheimers, the typical symptoms of mild mosaic develop. The yield of Bonte Industrie is little, if at all, inferior to that of normal plants. In the Thorbecke variety the symptoms of mild mosaic are almost completely masked, but the disease is readily transmissible to healthy Eigenheimers by grafting. Both Thorbecke and Triumph (which is similarly affected) give excellent yields.

Discussing the bearing of these facts on the cultivation of the varieties in question, the writer thinks that growers need not be unduly concerned over the presence of mild mosaic in their crops, since no adverse effect on the yield is to be anticipated if liberal supplies of manure are given.

BAILEY (H. L.). **Certified seed Potato inspection.**—*Fourteenth Bienn. Rept. Vermont Commissioner of Agric., 1926–1928*, pp. 70–79, 1928.

Mosaic and leaf roll are stated to be the two most serious degeneration diseases of Vermont potatoes. A considerable amount of net necrosis, now believed to be a form of leaf roll infection [*R.A.M.*, vii, p. 663], has also been found in tubers. Three regular inspections are necessary for the determination of these diseases, the symptoms of which may not all appear simultaneously.

Spindle tuber is not believed to occur to any appreciable extent under Vermont conditions, and recent researches indicate that no great importance need be attached to yellow dwarf and giant hill [ibid., iv, p. 501 ; v, p. 179].

Late blight [*Phytophthora infestans*] was very prevalent in 1927 and rotting of the tubers was common even in fields showing no general infection. Blackleg [*Bacillus atrosepticus*] was also widespread in 1927, probably owing to the great abundance of the insect vector of the disease, the seed-corn maggot [*Phorbia cilicrura*: ibid., vii, p. 664].

SNELL (K.). **Krebsfeste Kartoffelsorten.** [Wart-immune Potato varieties.]—xi pp. + 24 col. pl., Paul Parey, Berlin, 1929.

This atlas, to which a brief foreword is contributed by Dr. O. Appel, is designed to assist in the trials of wart- [*Synchytrium endobioticum*] immune potatoes in respect of identity and purity. The explanatory notes on the different varieties, as well as the introduction, are printed in German, French, and English.

De Bruyn (Helena L. G.). **De vatbaarheid van de Aardappelplant voor de Phytophthoraziekte en haar bestrijding.** [The susceptibility of the Potato plant to the *Phytophthora* disease and its control.]—Reprinted from *Landbouwkundig Tijdschr.*, xl, 483 (*Extra-nummer*), 15 pp., 2 diag., 1928.

In this paper the writer recapitulates her observations in connexion with varietal susceptibility to potato blight (*Phytophthora infestans*) [*R.A.M.*, v, p. 381] in relation to environmental conditions, and gives directions for the control of the disease by spraying with Bordeaux mixture. Reference is made to the work of various contemporary investigators on allied problems.

Říha (J.). **Ochrana Bramborů v době vegetace.** [Protection of Potatoes during vegetation.]—*Ochrana Rostlin*, viii, 4, pp. 94–97, 1 fig., 1928.

Attention of the local growers is called to the necessity of spraying potato crops with Bordeaux mixture to control outbreaks of early and late blight (*Alternaria solani* and *Phytophthora infestans*) and yellow leaf spot (*Cercospora concors*), which are stated to be yearly responsible for financial losses amounting to 100 million Kč. [over £600,000] in Czecho-Slovakia. A new horse-driven sprayer is now constructed by Messrs Klement in Hrobcy nad Labem [Bohemia] on the designs of Dr. Baudyš in collaboration with the author, at a cost of 3,850 Kč. [roughly £24 at the present rate of exchange]. Its capacity is 400 l. and it secures adequate protection of the foliage by the use of only about 600 l. of liquid per hectare, thus effecting an appreciable economy as compared with hand sprayers, besides ensuring a much more efficacious distribution of the fungicide on both sides of the foliage.

Braun (H.). **Untersuchungen zur Frage der Kartoffelbeizung.** [Investigations on the problem of Potato disinfection.]—*Pflanzenbau*, v, 11–12, pp. 161–177, 1928.

The writer tabulates and discusses in considerable detail the results of recent extensive experiments in the control of *Hypochnus* [*Corticium*] *solani* on potatoes by seed-tuber disinfection [*R.A.M.*, vi, p. 41]. The tubers (30 of each variety) were immersed for one hour in varying concentrations of corrosive sublimate, germisan, uspulun, formaldehyde, and betanal.

It was found that different varieties react diversely to fungicidal treatment. Thus, Kuckuck was considerably more susceptible to steeping injury than Preussen. This increased susceptibility, however, did not become noticeable until the spring, being probably correlated with the inception of germination. The date of steeping seems to exert only a limited influence on the efficacy of the treatment, and where germination is completely inhibited by suitable methods of storage (e.g., by low temperature) this factor is apparently of no importance. It was found that much higher concentrations could be used without risk of injury to the tubers in the winter than in the spring. There were indications that the injury to the tubers from seed treatment does not exactly coincide with an increased concentration of the fungicide, but that it is subject to eriodical fluctuations.

Considerable importance is attached to the fact that tuber disinfection causes no injury where proper precautions are observed, especially as regards the suppression of sprouting during storage. On the other hand, the difficulty of reaching a conclusion as to the general utility of the practice of seed-tuber steeping is enhanced by the fluctuations in varietal reaction and in the periodicity of susceptibility of the tubers to injurious concentrations of the fungicides.

MURRAY (R. K. S.). **A note on cover crops in relation to root diseases of Rubber.**—*Trop. Agriculturist,* lxxi, 4, pp. 233–236, 1928.

In discussing the part played in the spread of root diseases of *Hevea* rubber trees by the cover crops now used on most estates in Ceylon, the author records an instance of an old tea field cleared and planted with rubber in 1925, *Crotalaria* sp. and *Dolichos hosei* being set as cover. The tea stumps were not removed. In February, 1928, *Fomes lignosus* was abundant in patches throughout the field and appeared to have killed many rubber saplings and *Crotalaria* plants. In many instances the fungus had spread from the roots of one to the other host. *F. lignosus* was also noted on *Tephrosia candida.*

Creeping covers, especially *D. hosei,* favour root diseases by causing the surface soil to remain moist. The author noted a few trees growing in a rocky ravine, showing symptoms of root disease in their aerial parts. The ground was covered with a thick growth of *D. hosei,* beneath which *F. lignosus* was present over about half an acre in a very active condition, its mycelium covering even the boulders and having spread, apparently from a decaying log. Another instance was noted, in which a tree was infected at the collar, the mycelium of *F. lignosus* having spread along the runners of *D. hosei,* apparently without injuring this host. As the lateral roots of the tree, where they joined the collar, were unaffected, it was evident that the mycelium had spread more rapidly along the runners than underground.

On one estate immature fructifications of *F. lignosus* were found growing on dead runners of *D. hosei.*

ASHPLANT (H.). **Spraying of Rubber.**—*Bull. Rubber Growers' Assoc.,* x, 10, pp. 677–679, 1928.

In this paper [a reprint of the conclusion of the annual report of the Rubber Specialist to the United Planters' Association of Southern India] notes are given on the results of spraying tests with various mixtures and adhesives against the secondary leaf fall disease of *Hevea* rubber [*Phytophthora meadii*: *R.A.M.,* vi, pp. 117, 371; vii, p. 393].

In 1927, one of the worst years for the disease on record, spraying gave remarkably satisfactory results. Emphasis is laid on the necessity of using adequate amounts of Bordeaux mixture (at least 3½ to 4 galls. for a mature tree); a small quantity of highly concentrated mixture is less effective than a larger quantity more diluted. No significant difference was noted in the results given by Bordeaux and Burgundy mixtures, and provided the former is

accurately made and copiously applied, it will almost entirely prevent infection; in the author's opinion it is unsurpassed for effectiveness and cheapness.

When less quicklime was used (i. e., $1\frac{1}{2}$ lb. quicklime, 4 lb. copper sulphate, and 50 galls. water), the results obtained equalled those given when as much as 6 lb. quicklime were employed, but as the higher proportions of quicklime facilitate control of the application by enhancing its visibility the use of the smallest quantities is not recommended unless strict economy is imperative.

It is considered doubtful whether the addition of adhesives ever gives better results than would be obtained for the same cost by the use of a larger amount of Bordeaux mixture per tree. Of those tested, resin-soda proved the best.

During 1928, some of the rubber trees at an experimental station were sprayed with a more dilute mixture than the customary 4–4–50 formula (approximately 32 lb. each of copper sulphate and quicklime being used per acre) and when the worst of the monsoon had passed virtually no leaf fall had occurred throughout 80 acres.

THAKUR (A. K.) & NORRIS (R. V.). **A biochemical study of some soil fungi with special reference to ammonia production.**—*Journ. Indian Inst. Sci.*, xi A, 12, pp. 141–160, 4 graphs, 1928.

Using various synthetic media of definite chemical composition, the writers isolated and studied biochemically some fifty species of fungi from a clay loam soil in the grounds of the Indian Institute of Science, Bangalore. The organisms included various species of *Aspergillus*, *Penicillium*, and *Mucor* [cf. *R.A.M.*, viii, p. 129], and a number of others [which are listed].

Three of the organisms (*A. flavus*, *P. glaucum*, and *Armillaria* sp.) were examined for their power to fix atmospheric nitrogen with negative results.

Citromyces sp., *Armillaria* sp., and *Verticillium* sp. proved to be very strong cellulose decomposers; *C. glaber*, *Fusarium* sp., *Aspergillus niger*, and *A.* sp. were moderately active in this direction, while *A. flavus*, *A. fumigatus*, *P. glaucum*, and *Rhizopus nigricans* gave negative results.

The process of ammonia production by fungi has been examined, with special reference to the properties of an amidase isolated from *A. flavus*. The reaction is of an autocatalytic nature, the velocity curve first exhibiting a period of lag and then a period of acceleration as ammonia is formed.

PIŠPEK (P. A.). **Edafske mukorineje Jugoslavije.** [Soil-inhabiting Mucoraceae of Jugo-Slavia.]—*Izvješća Bot. Zav. Sveučil. u Zagrebu* [*Rept. Bot. Acad. Univ. of Zagreb*], iv, pp. 77–112, 15 figs., 1929.

Notes are given on 38 species of soil-inhabiting Mucoraceae, which were isolated from 200 localities in four different regions of Jugo-Slavia differing widely from one another in their climatic and topographical characters. Of this number 18 species are regarded as new; they are briefly described and illustrated, and Latin diagnoses of them are given. A separate table indicates the

regions in which each of the species was found, and the number of isolations in each case.

On the basis of this study no hard and fast rule could be established in regard to the geographical distribution of the species, although the individual regions differed in the general character of the fungal flora. Thus, in the Julian Alps a number of species were found which have been recorded by Lendner in Switzerland and in Norway by Hagem, while they were absent from the other regions, where species of the genus *Cunninghamella* were numerous. *Mucor stolonifer* is apparently the most widespread species, particularly in the Mediterranean coastal region, followed by *M. circinelloides*, *M. hiemalis*, *C. elegans*, *Absidia glauca*, and *A. spinosa*, while *A. orchidis*, *M. silvaticus*, and *Zygorrhyncus moelleri* are less frequently met with.

The nature of the above-ground vegetation appeared to play an important part in determining the species of moulds inhabiting the soil.

BLATTNÝ (C.). **Význačná ochuravěni zdřevnatělých částí a mladých výhonů Chmele.** [Outstanding diseases of the woody organs and young shoots of Hops.]—*Ochrana Rostlin*, viii, 5, pp. 117–128; 6, pp. 137–150, 9 figs., 1928.

This is another version of the author's previous paper on the same subject [*R.A.M.*, viii, p. 130], the information contained in both being identical.

NAOUMOFF (N. A.). О заболевании Хмеля под влиянием. **Pseudoperonospora humuli (Miyab. et Tak.) Wils.** [Hop disease caused by *Pseudoperonospora humuli* (Miyab. et Tak.) Wils.]—*La Défense des Plantes*, Leningrad, v, 3–4, pp. 369–370, 1928.

Downy mildew of hops (*Pseudoperonospora humuli*) is stated to have been recorded for the first time in the government of Louga [north-west Russia] in 1926 on wild hops. The infection was then mild and restricted to one locality on the banks of the river Louga. In 1928, however, the fungus was found to have spread considerably, many hop gardens in several districts of the government being heavily infected. The outstanding feature of the disease was that not only the lower, but even the topmost leaves were affected, the infection frequently spreading to the axes of the shoots, which were covered with dark, greyish purple efflorescenses of conidia over a length of up to 20 cm. This severe outbreak of the mildew is attributed chiefly to the abundance of rain during the summer of 1928, and shows that, given favourable conditions, the disease might assume catastrophic dimensions. No recommendations for control are made.

BELL (A. F.). **Report of the Sugar Pathologist.**—*Twenty-eighth Ann. Rept. Queensland Bureau of Sugar Exper. Stat.*, pp. 10–13, 1928.

Notes are given on the diseases of sugar-cane observed in Queensland during 1927–8. With the exception of the Eagleby district, good progress was made towards the complete control of Fiji

disease [*Northiella sacchari*: *R.A.M.*, viii, p. 133] in the Beenleigh area. Gumming (*Bacterium vascularum*) continues to be the chief disease and the position in the Bundaberg and Nambow districts is serious. Efforts are being made to find disease-free farms, to be inspected periodically and used for supplying 'seed'. Isolation nurseries for the propagation of disease-free cane are also being established. The Coimbatore seedlings Co. 210, 213, and 227 appear to be quite unaffected by this disease.

South of Cardwell, leaf scald (*Bacterium* sp.) is sporadic and any extension could be checked by adequate supervision. North of Cardwell the disease is epidemic, and present on nearly 100 per cent. of the farms. Neither leaf scald nor gumming can be controlled by the selection of individual stools in a field in or near which the disease is present. The chief local variety, Badila, has so far proved tolerant to leaf scald and in most cases the losses are insignificant. P.O.J. 2878 is also being tested in view of its resistance to the probably identical gomziekte [Java gum disease] in Java [but see ibid., viii, p. 226].

Red rot (*Colletotrichum falcatum*) [ibid., vii, p. 600] and other stem rots were very common in certain localities when drought stopped growth and caused 'over-ripening' in many fields.

WILES (D. R. D.). **Sugar Cane mosaic disease.**—*Ann. Rept. Dept. of Agric. Barbados for the year 1927–28*, pp. 15–16, 1928.

As a result of the increased prevalence of sugar-cane mosaic in Barbados a systematic inspection and destruction of diseased cane was conducted in 1927, certain heavily infected areas being delimited, within which only canes obtained from a source approved by the Department of Agriculture were allowed to be planted. Between October, 1927 and the following May, approximately one million healthy plants were delivered for this purpose. Legislation has also been introduced providing that maize, the favourite food plant of the insect vector *Aphis maidis*, may not be grown in certain areas at certain periods if likely to constitute a source of infection to the young canes.

Gesetze und Verordnungen. [Laws and regulations.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, viii, 11, p. 110, 1928.

PERU. Living plants and parts thereof (including seeds) may only be imported into Peru with the consent of the Government (Ministry of Agriculture). The plants must be accompanied by a certificate, attested by the Peruvian Consulate in the country of origin, vouching for their health and cultivation in a locality free from transmissible plant diseases. Consignments will be examined at the Callao-Lima customs-office by phytopathological experts.

BELGIAN CONGO. All plants and parts thereof (including seeds) imported into the Belgian Congo must be accompanied by a certificate guaranteeing their freedom from pests and diseases. Infected plants will be disinfected or destroyed at the cost of the importer.

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HANSFORD (C. G.) & MCLEOD (W. G.). **Sugar Cane in Uganda.**—*Uganda Dept. of Agric. Circ.* 19, 21 pp., 1928.

In the section of this circular (pp. 16–21) dealing with diseases of sugar-cane it is stated that mosaic was first discovered in Uganda in 1926, though on the one estate where it is present no canes had been imported for some years. The following susceptible cereals and grasses are found locally: maize, sorghum, *Echinochloa* [*Panicum*] *crus-galli*, *Digitaria horizontalis*, *Urochloa helopus*, *Setaria verticillata*, and *Eragrostis ciliaris*.

It is considered that the disease can be controlled by roguing, without resort to the resistant Uba variety, which is unsuited to Uganda conditions. The P.O.J. canes 213, 2714, 2722, 2725, 2728, 2878, and 2379 have been introduced as a further defence.

Streak disease has not yet been noted on sugar-cane but is present on maize. Brief notes are given on leaf spot (*Helminthosporium sacchari*), which is common but does little damage; wilt (*Cephalosporium sacchari*), of which only a few isolated cases have been seen in Uganda; and top rot, to which the Tanna canes are very resistant in Uganda, while soft varieties, such as B. 3922, Ceylon Nos. 2 and 3, Ceylon red, &c., are so susceptible that they have had to be abandoned.

CARPENTER (C. W.). **Conditions favouring Pythium development.**—*Hawaiian Planters' Record*, xxxii, p. 394, 1928. [Abs. in *Facts about Sugar*, xxiv, 3, p. 63, 1929.]

Laboratory experiments indicate that low temperatures favour the development of the zoospores of *Pythium aphanidermatum*, the sugar-cane root rot organism [*R.A.M.*, viii, p. 266]. This fact is correlated with the greater prevalence of the disease in the cool, wet winter months.

PRIODE (C. N.). **Pokkahbong and twisted top diseases of Cane.**—*Facts about Sugar*, xxiii, 52, p. 1244, 1928.

A brief, popular description is given of the symptoms of pokkah boeng [*R.A.M.*, viii, p. 134], which is reported to occur on the

recently imported P.O.J. 2878, 2727, 2714, and 2883 sugar-cane varieties in Cuba. Other susceptible varieties are Cristalina, D. 109, S.C. 12/4, F.C. 306, B.H. 10(12), Yellow Caledonia, and some of the Porto Rican seedlings. As in Java, a species of *Fusarium* is believed to be implicated in the causation of the disease [ibid., vii, p. 537].

Twisted top is a purely physiological disturbance resulting from the mechanical friction of the leaves, which appear to be held together and do not separate normally. The growth of the younger leaves from below causes a splitting and tangling of the older ones, which tend to envelop and tie up the young foliage. Sometimes the young leaves grow through the split older ones, but they are so closely enveloped by the latter that they cannot unfurl, and grow up as a slender, spiky mass of wrapped leaves. In other cases the spindles of the plants are not wrapped round by the older leaves, but the tips of the leaves are held together and form arches as the growth continues from below. The tip of each new leaf, as it emerges from the roll, becomes entangled with the older ones and a new arch is formed. This condition is most prevalent during dry weather.

ZAPROMETOFF (N. G.). Материалы по микофлоре Средней Азии. Выпуск **2-й**. [Materials for the mycoflora of Central Asia. Part 2.]—*Узбекистанская Опытная Станция Защиты Растений* [*Uzbekistan Exper. Plant Prot. Stat.*], Tashkent, Publ. 11, iii + 70 pp., 12 figs., 1928.

Continuing his systematic investigation of the fungal flora of Russian Central Asia [*R.A.M.*, vi, p. 123], the author gives notes on 542 species, 144 of which have already been recorded in the first list. Brief Latin diagnoses and illustrations are given in the case of the species considered to be new to science. The following records are of interest.

Tarichium jaczewskii n. sp. in the larvae of the wheat weevil (*Zabrus gibbosus*); the infected larvae blacken and dry up, and are entirely filled with resting spores of the fungus; the spores are spherical, blackish-brown, from 28 to 46 μ in diameter, and are provided with a double wall, 4·5 to 7 μ thick. *T. phytonomi* n. sp. in the larvae of *Phytonomus variabilis*; the resting spores are spherical, brown, 32 to 36 μ in diameter, with a double wall, 2·6 to 3·9 μ thick; the exospore is verrucose. This species differs from *T. megaspermum* [*Entomophthora megasperma*: *R.A.M.*, v, p. 228] in the size of the spores and in the warts covering the exospore.

Nineteen species of Perisporiales are recorded, physiologic forms being differentiated in most of them. *Oidium lini* Škorić [ibid., vii, p. 784] was found on flax leaves; *Leveillula* [*Oidiopsis*] *taurica* f. *carthami* on *Carthamus tinctorius*; *O. taurica* f. *medicaginis* on the leaves and stems of lucerne; *Uncinula altheae* n. sp. on the upper side of the leaves of *Althaea officinalis*, in association with *Phyllactinia suffulta* [*P. corylea*]: the mycelium is delicate and evanescent; the perithecia are rounded, black, 70 to 90 μ in diameter, and supplied with 13 or 14 spirally wound appendages measuring 80 to 120 by 4 to 6·5 μ; the asci are ovoid, 42 by 28 μ, and contain 6 ellipsoidal, hyaline spores measuring 21 to 28 by 14 μ.

Oidium melongena n.f. (believed to be a conidial form of *Erysiphe polygoni*) forms a purplish efflorescence on the lower side of the leaves of the eggplant; the conidia are elongated, cylindrical, faintly yellowish-brown, and measure 45 by 14 to 15 μ.

Among the 22 species of Pyrenomycetes listed is *Pleosphaerulina briosiana* on lucerne [cf. ibid., vi, p. 272]. The 36 species of smuts include *Ustilago bulgarica* Bubák on the inflorescence of *Andropogon halepensis*, *Tilletia hordei* Koern. on *Hordeum bulbosum* (with a var. *spontanei* n. var. on *H. spontaneum*), and *Urocystis cepulae* on wild garlic (*Allium* sp.). Of the 169 species of rusts, *Pileolaria terebinthi* (syn. *Uromyces terebinthi* Wint.) on *Pistacia vera* and *Chrysomyxa deformans* on *Picea schrenkiana* [ibid., vi, p. 328] may be mentioned. The 19 species of Hymenomycetes listed include *Polyporus fumosus* on apple, *P.* [*Fomes*] *igniarius* on almond and *Prunus divaricata*, and *Trametes trogii* on pears.

The Fungi Imperfecti are represented by 170 species, including *Phyllosticta medicaginis* on lucerne; *Sclerotiopsis hibisci* n. sp. on the stems of *Hibiscus cannabinus* (the pycnidia are depressed-globose, 500 by 320 μ in diameter; the stylospores are hyaline, ovoid-ellipsoidal, 3 to 4 by 1 μ, and are borne on filiform conidiophores); *Ascochyta trifolii* on *Trifolium repens*; *Septoria buharica* N. Naoumova on the leaves of wild vines (*Vitis vinifera*); *S. graminum* on wheat, *Festuca arundinacea*, and *Agrostis verticillata*; *S. pistacina* on the leaves of *Pistacia vera*; *S. tritici* on wheat and *Dactylis glomerata*; *Cylindrosporium moricola* Jacz. (syn. *Phleospora moricola* Sacc. and *Septoria moricola* Passer.) on *Morus alba*; *Oospora verticillioides* on split grains of maize; *Fusarium vasinfectum*, stated to be omnipresent in Russian Central Asia on cotton (*Gossypium hirsutum* and *G. herbaceum*) and on *Hibiscus esculentus*; *F. bucharicum* Jacz. n. sp. on Bokhara cotton (*G. herbaceum*), on which it causes a collar rot and a rapid withering of the plants; *Cladosporium fasciculatum* on overwintered stems of the vine; *Fusicladium saliciperdum* on the leaves of *Salix triandra*; *F. sorghi* on the leaves of *Andropogon halepensis*; *Sporodesmium cladosporii* on vine shoots and on the inflorescences of species of *Tragopogon*; *Macrosporium nigricans* on the leaves of cotton (*G. hirsutum*), and also causing a black discoloration of cotton fibres. The roots of this species of cotton are also attacked by *Rhizoctonia violacea* [*R. crocorum*], which is one of the five sterile mycelial fungi recorded.

The pamphlet terminates by an alphabetical index of all the hosts recorded in this list and in the former one. A bibliography of 45 titles is also given.

JANKOWSKA (KRYSTYNA). **Zewnętrzniaki polskie.** [Exoascaceae of Poland.]—*Mém. Inst. National Polonais d'Écon. Rur. à Pulawy*, ix, 1, pp. 182–215, 4 pl., 1928. [English summary.]

After a brief review of the existing literature on the systematic position of the Exoscaceae, the author discusses the results obtained by other workers in culturing fungi belonging to this family, and describes in some detail her own successful attempts to culture *Taphrina sadebecki* on various media, of which a potato extract

2 per cent. dextrose agar proved the most successful. On this medium the ascospores germinated abundantly; the conidia that were produced measured 4 to 5 by 2 to 4 μ and were joined in chains of 2 or 3 (occasionally 4); short hyphae up to 25 μ in length were rarely seen, but no copulation of the conidia was observed.

A description of 28 species is given, most of which have been found in Poland (four being new records for that country), while the presence of the few remaining is believed to be probable there. Mention is also made of *Cladosporium exoasci* Lindau and *Phoma fructicola* Siem., which are frequently found developing as saprophytes on fructifications of *Taphrina pruni* and *T. rostrupiana*. In a separate table are listed all the hosts of the Exoascaceae so far recorded in Poland.

SMALL (W.). **Mycological notes (16). The parasitism of Rhizoctonia bataticola (Taub.) Butler and other fungi.**—*Trop. Agriculturist,* lxxi, 4, pp. 215–227, 1928.

The author brings forward further evidence in support of his contention that root disease of various economic crops in Ceylon and elsewhere is due to active parasitism by *Rhizoctonia bataticola* [*Macrophomina phaseoli*: *R.A.M.*, vi, p. 742; viii, p. 137] and criticizes in detail the validity of his opponents' views.

TUNSTALL (A. C.). **Vegetable parasites of the Tea plant (continued). Blights on the stem (continued).**—*Quart. Journ. Indian Tea Assoc., 1928*, 4, pp. 220–231, 1928.

Continuing his account of the vegetable parasites of the tea plant [*R.A.M.*, vii, p. 746], the writer gives notes on the history, symptoms, and control of the following stem blights. Horsehair blight (*Marasmius equicrinis*) [ibid., v, p. 7] causes little damage in north-east India, where the fructifications of the fungus are rarely observed on tea.

Blue velvet blight (*Septobasidium* sp.) was fairly prevalent in Darjeeling in 1911, but is now seldom found owing to improved methods of pruning and spraying. Usually the fungus only develops on the scale insects attacking the tea stems, but occasionally it may infect the plant to a slight extent. Brown velvet blight (*S.* sp.) differs little from the foregoing except in the colour of the coating formed on the collar and underground portions of the tea bushes. Below soil level the fungus externally resembles the causal organism of brown root rot (*Fomes lamaoensis*), but there are no brown streaks in the interior of the wood.

Red rust (*Cephaleuros mycoidea* and *C. parasiticus*) is of importance only on bushes weakened through various causes. Control measures [which are indicated] should be based on an improvement in the general health of the plantations.

Brown blight (*Glomerella cingulata*) is very prevalent in the Dooars on the stems as well as on the leaves. The tea mosquito [*Helopeltis*] has been observed to carry the spores in large numbers, but the examination of many punctures caused by this insect failed to reveal a single case of the penetration of the fungus

Owing to improved sanitation the occurrence of dead 'snags' or pruned branches is much less common than formerly. Directions are given for a further reduction of the wood rot due to their presence by cultural measures, supplemented by painting the pruning wounds with a mixture of 4 lb. copper sulphate in 1 gall. water and 4 lb. soda or 2 lb. soda ash in the same quantity of water.

Various fungi are often found on cankered stems, but none of the organisms appears to be directly concerned in the causation of this disturbance. Affected branches should be excised and lime-sulphur applied after pruning. *Nectria cinnabarina* may be found in cankered wood, but as a rule this fungus does not produce cankers on tea.

Böning (K.). **Die Wildfeuerkrankheit des Tabaks.** [The wildfire disease of Tobacco.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz,* vi, 9, pp. 210–214, 1928.

This is a popular account of the symptoms and etiology of tobacco wildfire (*Bacterium tabacum*) in Bavaria [*R.A.M.*, vii, pp. 547, 548]. Recommendations are given for the control of the disease by cultural methods, supplemented by spraying with Bordeaux mixture (0·5 to 1 per cent. in the seed-beds and 1 to 2 per cent. in the field).

Hopkins (J. C. F.). **Preliminary experiments on the control of white mould of Tobacco.**—*Rhodesia Agric. Journ.*, xxv, 12, pp. 1342–1348, 1 graph, 1928.

White mould of tobacco (*Erysiphe cichoracearum*) [*R.A.M.*, vii, p. 618], which is common throughout Rhodesia, where in some districts it may cause up to 50 per cent. loss of crop in individual fields, usually appears early in February, though isolated plants, and those in pots or greenhouses, may be affected at any time. Infection is favoured by drought, but is often most severe after cold, damp nights. Periodicity in spore formation (which is apparently most rapid in dry weather, while vegetative growth is favoured by cool, damp conditions) is thought to influence the time and extent of infection.

Experiments were conducted in which plots of the susceptible Hickory Pryor variety received, respectively, one, two, and three applications (on 31st January, 10th and 25th February) of ordinary vine-dusting sulphur, at the rate of 40 lb. (costing approximately 14*s.*) per acre. The sulphur was applied to the soil in handfuls between the rows, and care was taken to prevent any from blowing on the leaves [cf. ibid., vi, p. 516; vii, p. 278]. Two plots remained untreated. At harvest time the latter showed, respectively, 39·4 and 54·7 per cent. infection, while complete control was given in the others even by one application.

Though chemical analysis of the leaves failed to reveal any deleterious effects, definite recommendations for the use of sulphur are not made pending tests of the treatment on the quality of the crop.

TISDALE (W. B.). **A disease of Tobacco seedlings caused by Septomyxa affinis (Sherb.) Wr.**—Abs. in *Phytopath.*, xix, 1, p. 90, 1929.

Tobacco seed-beds in Florida are liable to suffer from a disease characterized by irregular, olivaceous blotches on the upper surface of the leaves and similar blotches or streaks on the petioles and stems. Under humid conditions (such as prevailed in 1928), the affected parts develop a soft rot, resulting in a ragged appearance of the leaves and the damping-off of the petioles and stems. Plants artificially inoculated with spores of the causal organism develop severe damping-off within five days in a moist atmosphere. Slightly infected plants recover on transference to the field. The disease usually occurs on shady portions of the beds. A similar trouble has been reported from Connecticut, Ohio, and Kentucky, where it is attributed to a species of *Fusarium*. A morphological examination showed the organism to be closely related to *F. affine* Sherb. or *Septomyxa affinis* (Sherb.) Wollenw. according to Wollenweber's new combination.

STAIR (E. C.), BROWN (H. D.), & HIENTON (T. E.). **Forced ventilation as a means of controlling Tomato Cladosporium and Septoria in hotbeds.**—*Phytopath.*, xviii, 12, pp. 1027–1028, 1928.

Tomato plants grown for 45 days in a hot-bed ventilated with a 12-inch electric fan blowing air over an electric heater to keep the atmosphere dry were twice inoculated with *Cladosporium fulvum* and *Septoria lycopersici*, but failed to contract infection [cf. *R.A.M.*, vii, p. 749]. Both fungi caused severe damage in an adjacent control bed. Inoculated plants in a third bed were maintained in a healthy condition by weekly applications of Niagara D. 25 copper-lime dust. The average daily temperature at 11 a.m. in the bed ventilated by electricity was 64° F. compared with 73° in the control and 66° in the dusted bed.

The Dutch Elm disease (Graphium ulmi Schwarz).—*Forestry Comm. Leaflet* 19, 6 pp., 4 figs., 1928.

A brief, popular account is given of the Dutch elm disease (*Graphium ulmi*) [*R.A.M.*, viii, p. 141] which is stated to be now so prevalent in the south, east, and centre of England, especially on trees between 15 and 40 years of age, that little hope of its eradication remains. The spread of infection may, however, be checked if, in acute cases, the tree is felled, the twigs and branches destroyed, and the trunk cut up for firewood, or otherwise disposed of. The stump should be carefully tarred, the process being repeated a few months later, as the fungus has been found to fructify freely on diseased wood, especially in cracks between the bark and wood. If the disease is progressing slowly, or is confined to isolated branches in the crown, remedial measures need not be adopted at once, as slightly infected trees may possibly recover. In large trees, valuable for aesthetic or other reasons, the infected branches should be cut back to sound wood flush with a larger branch or main stem, the cut surfaces being repeatedly tarred and the diseased branches burnt.

Brussoff (A.). **Ueber die Ursache des Ulmensterbens. Eine Erwiderung auf den Artikel von Dr. C. Stapp, Seite 139 ff.** [On the cause of the Elm die-back. A reply to the article of Dr. C. Stapp, pp. 139 *et seq.*]—*Mitt. Deutsch. Dendrol. Gesellsch.*, xl (*1928*), pp. 292–297, 2 pl., 1928.

In reply to Stapp's criticism of his theory concerning the etiology of the die-back of elms [*R.A.M.*, vii, p. 681], the author still maintains that *Micrococcus ulmi* is the responsible organism. The objection to the use of a liquid medium was met by the author, in his recent isolations, by the consistent employment of meat agar, on which pure cultures of *M. ulmi* have been obtained from elms, silver maples [*Acer dasycarpum*], limes, and beech. In 22 out of 26 elms from which isolations were made between March and May, 1928, he also obtained a rod-shaped organism both from twigs and roots. The significance of these organisms, which occur in the vessels chiefly of the smaller twigs, has not yet been elucidated, but the cocci are still considered to be the primary cause of the epidemic disease of elms. In no case did the author succeed in isolating *Graphium ulmi* from the early stage of the disease [see next abstract].

Wilson (Mary J. F.). **Über das Ulmensterben und seinen Erreger.** [On the die-back of Elms and its cause.]—*Zeitschr. für Pflanzenkrankh. (Pflanzenpath.) und Pflanzenschutz*, xxxix, 1, pp. 36–39, 1929.

During July and August, 1927, the writer carried out a series of inoculation experiments at the Munich Forestry Institute with a pure culture of *Micrococcus ulmi* [see preceding abstract] on *Ulmus campestris* and *U. montana*, beech, lime, *Acer pseudoplatanus*, *Quercus pedunculata*, *Populus nigra*, *Crataegus oxyacantha*, *Salix alba*, cherry, and almond. Apart from the beech, which showed premature yellowing of the leaves and defoliation, accompanied by a faint greenish-brown discoloration of the woody tissues near the point of inoculation, none of the trees reacted to the injections.

According to a verbal communication from Brussoff, the strain of *M. ulmi* used in these tests had already been in pure culture for nearly three years, and might, therefore, have lost any virulence it originally possessed. Another culture of *M. ulmi* given to the author by Brussoff, and examined on her return to Edinburgh, yielded only rod-shaped bacteria of two different species on a liquid medium. On receiving a pure culture of *M. ulmi* from Brussoff in April, 1928, the author inoculated two elms (*U. campestris* of Scotch origin) with this organism, while a third was inoculated with both *M. ulmi* and *Graphium ulmi*. So far none of the trees has shown any sign of infection.

The author is persuaded, as a result of these experiments, that *M. ulmi* is not responsible for the die-back of elms, which Wollenweber's and Dr. Buisman's investigations [ibid., viii, p. 205] are considered to have conclusively shown to be due to *G. ulmi*.

LIESE [J.]. **Die Rostpilzerkrankungen der Waldbäume.** [The rust fungus diseases of forest trees.]—*Mitt. Deutsch. Dendrol. Gesellsch.*, xl (*1928*), pp. 158–175, 4 pl., 1 fig., 1928.

Descriptions are given in popular terms of the life-history of the following fungi causing diseases of forest trees, together with notes on their distribution, host range, effects, and control: white pine blister rust (*Cronartium ribicola*) [*R.A.M.*, vii, p. 482]; blister rust of Scotch fir (*Pinus sylvestris*) caused by *C. asclepiadeum* and *Peridermium pini* [ibid., iv, p. 376], and needle rust of the same host (*Coleosporium* spp.), spruce needle rusts (*Chrysomyxa ledi*, *C. rhododendri* [ibid., vii, p. 686], and *C. abietis*), juniper rusts, including the two species *G. juniperinum*, the alternate host of which is mountain ash (*Sorbus* [*Pyrus*] *aucuparia*) and *G. sabinae*, the alternate host of which is pear; the buckthorn rusts *Puccinia coronata* and *P. coronifera* [*P. lolii*] on *Rhamnus frangula* and *R. cathartica*, respectively; the cone rust of *Picea excelsa* (*Thecopsora areolata*) [ibid., v, p. 197]; *Calyptospora goeppertiana* on *Abies pectinata*, with a teleuto stage on *Vaccinium vitis-idaea*; *Melampsora pinitorqua* on *Pinus sylvestris*, *P. strobus*, and *P. monticola* (teleuto stage on *Populus tremula* and *P. alba*) [ibid., vi, pp. 201, 701]; larch rust *M. larici-tremulae* (alternate stage as in *M. pinitorqua*); birch rust (*Melampsoridium betulinum*), infecting larch needles in spring and forming its alternate stage on *Betula pendula*; and *Melampsorella caryophyllacearum*, the causal organism of witches' broom and canker of *A. pectinata* [ibid., vi, p. 453], with its alternate stages on species of *Stellaria*, *Arenaria*, *Cerastium*, *Moehringia*, &c.

HUBERT (E. E.). **Relation of forest management to the control of White Pine blister rust.**—*Journ. of Forestry*, xxvi, 7, pp. 892–898, 1928.

The forest area in northern Idaho, where white pine blister rust [*Cronartium ribicola*: *R.A.M.*, viii, p. 1] was discovered in 1927, covers 25,754,000 acres, and includes 2,655,372 acres of western white pine [*Pinus monticola*], equivalent to 13,534,000,000 board feet, and representing 26·4 per cent. of the total board foot stand for all species. There are numerous wild species of *Ribes*, but the cultivated black currant [*R. nigrum*] has been virtually exterminated, and the mature stands are almost *Ribes*-free, as the latter does not flourish except where there are openings in the forest cover.

It is suggested that the forest area requiring protection can be greatly reduced by considering only those areas bearing commercially valuable or reproduction stands of white pine, by gradually eliminating species of *Ribes* in mature and nearly mature well-stocked stands, and by single burns of sufficient intensity to destroy the undergrowth (with heavier or more numerous burns at the margins). Apart from such burns, the suppression of forest fires is of the utmost importance, since *Ribes* develops in great numbers in burnt-off areas. In logging, a residual stand of fair density should be left, as *Ribes* does not flourish under such conditions, especially if there has been a minimum disturbance of the undergrowth. Every effort should be made to increase the density of reproduction in cut-over areas, as this helps in the suppression of *Ribes*.

ZACH (F.). **Über Ceratostomella cana E. Münch als Varietät von Ceratostomella piceae E. Münch.** [On *Ceratostomella cana* E. Münch as a variety of *Ceratostomella piceae* E. Münch.]—*Zeitschr. für Pflanzenkrankh. (Pflanzenpath.) und Pflanzenschutz*, xxxix, 1, pp. 29–35, 11 figs., 1929.

The principal differences between *Ceratostomella piceae* and *C. cana* as described by Münch (*Naturw. Zeitschr. für Land- und Forstw.*, v, [p. 531], 1907; vi, [pp. 32, 297], 1908), are briefly recapitulated. During the last five years *C. cana* was only found twice by the writer in Upper Austria, on both occasions on Scotch fir [*Pinus sylvestris*] wood in a humid atmosphere.

A culture of the fungus, maintained since 1923, suddenly developed incipient perithecia (hitherto unknown in this species which was originally described as producing *Graphium* spores only), accompanied by numerous *Graphium* spores of the *piceae* type. From further observations and experiments it was found that the *cana* type of growth, which is characterized by remarkable luxuriance and rapidity, occurs only under particularly favourable conditions, e. g., on freshly cut wood. By transferring the cultures from this medium to less nutritious substrata it was possible to effect a reversion to the natural *piceae* form of growth. When replaced on fresh wood, the fungus once more produced the typical chalky *Graphium* spores of the *cana* form, with numerous hyphae bearing globular or ellipsoid, rapidly germinating spores, together with a few conidiophores yielding the normal *piceae* conidia.

It is apparent from these studies that *C. cana* is only a variant of *C. piceae* occurring under certain well-defined conditions, and it should therefore be known as *C. piceae* var. *cana*.

KATAYEVSKAYA (Mme. N. I.). **Чага. [К изучению гнилей древесных пород).** ['Tchaga.' (Contribution to the study of tree rots).]—Reprinted from *Mitt. aus dem Forstl. Versuchsw.*, Omsk, i, 6, 12 pp., 4 figs., 1928.

'Tchaga' is the common name under which are known in Siberia the peculiar black excrescences occurring on the stems of birches and which Vanine in a previous paper [*R.A.M.*, vii, p. 483] also recorded on elms and mountain ash. In Siberia (where an infusion from them is sometimes used instead of tea) they are only found on two species of birch (*Betula verrucosa* and *B. pubescens*), following frost or mechanical injury and associated with a distinct heart rot. Their incidence tends to increase with the altitude, in about the same proportion as the number of fructifications of *Polyporus* [*Fomes*] *igniarius* decreases.

Usually the growths appear as black cushions, 10 to 15 cm. in diameter and 5 to 8 cm. thick, but when they develop in frost cracks they may attain an uninterrupted length of 1·5 m. The largest sample collected weighed (air dry) 1·5 kg. Their surface is generally rough and cracked, and the larger specimens may be divided by deep and broad cracks into several irregular sections. The black pigmentation is restricted to a thin superficial layer, the interior of the mass being uniformly rusty brown, sometimes faintly stratified. In section they consist of a dense weft of brown, thick-walled, frequently septate hyphae, 6 to 9 μ in

diameter, disposed in parallel, wavy layers. Internal cavities are lined with a rusty brown, loose mycelium, but were never found to contain spores. The chief difference in the structure of these outgrowths and that of the fructifications of *F. igniarius* is the absence of any stratification in the latter, and no intermediate form from one to the other was observed. The rot associated with these tumours is very similar to that caused by *F. igniarius*, and is characterized by the presence in the affected wood of numerous concentric black lines and a brown margin (up to 1 cm. broad) separating the diseased from the healthy wood.

In comparative cultures on the same media of several strains of *F. igniarius* from birch, aspen, and willow, and of the 'tchaga' organism, the chief difference between the two series [which are described at length] was that the strains of *F. igniarius* consistently refused to form fructifications on all the media tested, while well-defined fructifications were formed by the other organism on birch sawdust (but not on birch shavings), malt extract agar, and occasionally on potato dextrose agar. The fructifications were irregular semi-globose bodies, 2 to 2·5 cm. in diameter, of a dirty yellow colour externally and chestnut-brown inside. The surface of the mature fructification was pitted with irregularly rounded tubes, from 116 to 135 μ in diameter, sometimes with setae, measuring 60 to 68 by 6 μ in their interior. Basidia developed in these tubes, each bearing four one-celled, hyaline, oval spores, 6 to 7 by 4·2 to 5 μ, on short sterigmata. In mass the basidiospores were of a pale greyish-yellow colour.

On the basis of these observations, the author tentatively identifies the 'tchaga' fungus as a sterile form of *F. igniarius*, although she can offer no explanation of the fact that it formed fructifications on some of the media, while *F. igniarius* never produced any.

HUBERT (E. E.). **Manual of wood rots for cruisers and scalers in the Inland Empire.**—65 pp., 15 pl., *The Timberman*, Portland, Oregon. [Undated, received February, 1929.]

This is a popular account, intended for scalers and cruisers attached to pulp- and paper-manufacturing companies in the 'Inland Empire' (comprising western Montana, Idaho, eastern Washington, eastern Oregon, and south-eastern British Columbia), of the principal fungous rots of timber. The various types of decay are briefly classified and described, and the manual is illustrated by excellent photographic reproductions of the fungi concerned and the different kinds of damage produced.

PAPE (H.). **Fragekasten.** [Questions and answers.]—*Mitt. Deutsch. Dendrol. Gesellsch.*, xl (*1928*), pp. 362–366, 1 pl., 1928.

Answers are given to correspondents in connexion with various phytopathological matters, control measures being indicated in each case.

A die-back of cherry laurels [*Prunus lauro-cerasus*], imported from Belgium in an apparently healthy condition, was found to be associated with the presence of a species of *Cytosporina* in the discoloured areas of the cortex.

The leaves of a lime tree [*Tilia* sp.] growing at a height of 800 m. above sea level in the Black Forest were found to be attacked by *Cercospora microsora*. *Exosporium ulmi*, hitherto known as the causal organism of a twig blight of elms (*Mykol. Zentralbl.*, i, p. 35, 1912), was found on desiccated lime twigs submitted for examination, apparently causing a disease on this host similar to that which it causes on elms.

American red oaks [*Quercus coccinea*] were found to be infected by a species of *Dothidea*, presumably *D. noxia*, causing a reddish-brown discoloration of the cortex and a die-back of the trunk and shoots above the point of attack.

American willows [*Salix americana*] were severely attacked by crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*), more than 50 per cent. of the trees being affected in one plantation. Metabolic disturbances consequent on excessive humidity or superabundance of nitrogenous fertilizers may have predisposed the plants to infection.

MAGERSTEIN (Č.). **Škodliví činitelé na košikářské Vrbě v r. 1927.** [Causal factors of injuries to basket Willows in 1927.]—*Ochrana Rostlin*, viii, 5, pp. 128–130, 1928.

This is a brief account of the damage done to basket willows in Czecho-Slovakia in 1927 by meteorological factors and insect and fungus parasites. Among the latter, rust (*Melampsora* sp.) was very prevalent on *Salix acutifolia*, but was also fairly abundant on *S. viminalis* and *S. purpurea*; *Rhytisma salicinum* occurred sporadically, chiefly on *S. uralensis*; *Flammula connissans* was found on old trees of *S. amygdalina* and *S. triandra*; *Collybia velutipes* was very frequent on dead and living wood of old willow trees belonging to various species; and *Polyporus fumosus* was also found in large numbers, especially along river banks.

FISCHER (F.) & LIESKE (R.). **Untersuchungen über das Verhalten des Lignins bei der natürlichen Zersetzung von Pflanzen.** [Investigations on the behaviour of lignin in the natural disintegration of plants.]—*Biochem. Zeitschr.*, cciii (*Festschrift*), pp. 351–362, 2 figs., 1928.

Comprehensive investigations [which are fully described] showed that the disintegration of plants under natural conditions is characterized, in the first instance, by the decay of the hydrolysable constituents, while the relative proportion of lignin increases as dissolution proceeds.

An analysis of decayed fir [? *Abies*] wood showed that the microscopic structure was not in the least affected by the disintegration of the cellulose. Some of the samples of wood examined contained 85·55 per cent. lignin, yet in spite of the heavy loss of cellulose their external structure remained practically unchanged. Three samples of fir wood disintegrated by pure cultures of *Merulius lacrymans* were found to contain 47·40, 52·08, and 57·90 per cent. lignin, respectively [*R.A.M.*, vii, p. 690]. The hydrogen-ion concentration was found to be uniformly higher in naturally decayed samples than in those infected by pure cultures of *M. lacrymans*. In nature the initial acid is washed away, or removed through the action of micro-organisms, so that acid-intolerant bacteria can participate in the further process of disintegration.

HRUBAN (V.). **Konservace dřeva v zemědělství.** [Timber preservation in agricultural practice.]—*Ochrana Rostlin*, viii, 6, pp. 162–176, 5 figs., 1928.

In this paper the author briefly discusses the advantages and drawbacks, from the point of view of agricultural needs, of the methods of timber preservation in current use in various countries. Impregnation of the wood with coal-tar oils or creosote is very effective in prolonging the life of the timber and is comparatively cheap, but its use is restricted in agriculture by the fact that plant supports thus treated are known to be injurious to the plants, and also owing to the strong, unpleasant smell given off by the creosoted wood, which renders it unfit for indoor use. Kyanization (steeping the timber in solutions of mercuric chloride) [*R.A.M.*, iv, p. 454] is also very effective, but the wood is penetrated only very slightly by the solution. Efforts have therefore been made to obtain preservatives with better penetration, and a brief description is given of two new methods, namely, that of Bubov, in which the timber is first steeped in sodium fluoride solution, and then in the mercuric chloride solution; and that of Himmelbach, in which the logs are first steamed and then kyanized. The preliminary steaming causes the formation of cracks in the logs, through which the mercuric chloride solution penetrates deep in the wood, and thus affords a a considerably increased degree of preservation.

Steeping the timber in copper sulphate solution affords a very transient preservation for hop poles or vine supports, and has been practically abandoned in Czecho-Slovakia. Other methods, such as charring the poles, painting, and the like, are also of little value, and require to be repeated at least every year.

WHITE (H. E.) & GARDNER (M. W.). **Bacterial spot of Radish and Turnip.**—Abs. in *Phytopath.*, xix, 1, p. 97, 1929.

Radishes and turnips in Indiana were attacked by a bacterial spot disease in 1928. The leaf blades, petioles, stems, and seed pods of radish were heavily spotted, the petiole lesions being particularly destructive. Bacteria forming similar yellow colonies were isolated from both hosts, and seedlings of both contracted infection in the greenhouse as a result of cross-inoculation experiments. Evidence of transmission on radish seed was obtained. In greenhouse tests the organism also infected cabbage, Brussels sprouts, cauliflower, mustard, and tomato.

ZAUMEYER (W. J.). **Seed infection by Bacterium phaseoli.**—Abs. in *Phytopath.*, xix, 1, p. 96, 1929.

Recent studies have shown that *Bacterium phaseoli* [*R.A.M.*, vii, p. 496] may pass into developing bean seeds through the vascular system of the plant without causing any visible macroscopic symptoms. From dorsal suture infection of the pod, the bacteria invade the funiculus, passing through the raphe into the seed-coat. Entrance may also be effected through the micropyle of the seed when the bacteria invade the pod cavity; the latter may be reached either through the stomata of the pod or by rupturing the vascular tissue of the pod sutures. In the seed-coats the bacteria traverse the large intercellular spaces and are later found surrounding the cotyledons, which are penetrated at the time of germination

(not before) through natural rifts in the epidermal cells. This subsequently results in the systemic invasion of the developing seedling.

BUDDE (A.). **Ueber Rassenbildung parasitischer Pilze unter besonderer Berücksichtigung von Colletotrichum lindemuthianum (Sacc. et Magn.) Bri. et Cav. in Deutschland.** [On the formation of strains in parasitic fungi with special reference to *Colletotrichum lindemuthianum* (Sacc. et Magn.) Bri. et Cav. in Germany.]—*Forsch. auf dem Gebiet der Pflanzenkrankh. u. der Immunität im Pflanzenreich*, v, pp. 115–147, 1 fig., 1 graph, 1928.

After a general survey of the literature on the development of physiological forms in parasitic fungi, with special reference to the causal organism of bean anthracnose (*Colletotrichum lindemuthianum*) in Germany, the writer describes the results of his recent investigations on 46 isolations of this fungus from different parts of Germany, 2 from Sweden, and 1 from Holland [*R.A.M.*, vii, p. 133]. Five of the German strains differed considerably from the remainder in their effect on a number of varieties of *Phaseolus vulgaris* var. *nanus*. Thus, A (Calbe) attacked all the German varieties used in the tests with great virulence, and also infected some of the American ones; Low Champion Bush and White Dutch Case Knife were apparently immune. B (Schöningen) behaved similarly to A, except that it did not infect the ordinarily susceptible Round Pod Kidney Wax variety. The stability of the biological and pathogenic characters of these two strains was demonstrated by repeated tests. C (Freienwalde) attacked Wachs Schlachtschwert and Früheste Nordstern with the utmost severity, but caused little damage to Wachs stringless Hinrichs Riesen. D (Herbern) behaved similarly to C, the Früheste holländische Schwert also being susceptible to this strain, which closely resembles the 'alpha' strain of Barrus [ibid., iii, p. 110], while the Bunte and Weisse Hinrichs Riesen are immune. E (Durlach) differed from the other German strains only in its capacity to infect the Wachs Ideal (Terra) variety. One of the German isolations (Steilshoop) differed from all the others in morphological and cultural characters so markedly that it is regarded as a distinct variety of *C. lindemuthianum*, though in its pathogenicity it resembled the bulk of the German isolations, all of which, excepting those mentioned above, are grouped together as strain X. Strains A and B further showed cultural and morphological peculiarities which distinguished them from the rest of the German material. The two Swedish strains and the Dutch one were also distinct. A table is given showing the reaction of a number of bean varieties to infection with the nine biological forms above mentioned.

Certain strains of *C. lindemuthianum* formed, under special cultural conditions [which are indicated], sclerotial bodies, the significance of which has not been determined.

HARTER (L. L.). **A Fusarium disease of Beans.**—Abs. in *Phytopath.*, xix, 1, p. 84, 1929.

In August, 1928, several varieties of field beans [*Phaseolus vul-*

apparently new disease due to a *Fusarium* of the *Elegans* section. The fungus traverses the fibrovascular bundles of the stem, causing a conspicuous discoloration, and extends into the branches and leaf petioles. No wilting was observed, but the affected plants were somewhat dwarfed and showed a pale green, later bright yellow discoloration of the leaves, which subsequently withered and fell. The typical symptoms of the disease were produced by inoculation with the above-mentioned *Fusarium*.

KREŠL (F. X.) & PESKA (A.). **Ein Beitrag zur Bekämpfung der Cercospora beticola auf Zuckerrübe.** [A contribution to the control of *Cercospora beticola* on Sugar Beet.]—*Zeitschr. für Zuckerind.*, liii, 16, pp. 177–180, 1928.

In 1928 the writers conducted a series of experiments in the control of beet leaf spot (*Cercospora beticola*) [*R.A.M.*, vii, p. 613] in Czecho-Slovakia, using 3 per cent. Bordeaux mixture, peronoid copper-lime dust, and cusisa. The plants in the plots treated with Bordeaux mixture were practically free from infection and about 10 cm. taller than the controls. The average increase of yield as a result of the treatment was estimated at 20q. per hect. It is pointed out that the incidence of leaf spot was much lower in 1928 than in 1926 and 1927, and that in years of severe epidemics the increased yield from spraying might be expected to be proportionately higher. Peronoid gave moderately good control but cusisa proved unsatisfactory.

HILTNER (E.). **Beobachtungen über die Herz- und Trockenfäule der Rüben—eine Umfrage.** [Observations on the heart and dry rot of Beets—a questionnaire.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, vi, 9, pp. 214–218, 1928.

The increasing prevalence of heart and dry rot of beets [*R.A.M.*, viii, p. 217] in Bavaria during 1928 resulted in an attempt, on the part of the National Institute for Agriculture and Plant Protection, to elicit information from local agricultural societies and farmers as to the conditions governing the occurrence of the disease. The replies to the questionnaire indicated that liberal applications of nitrogen, especially in the form of saltpetre and liquid or stable manure, favour the development of heart and dry rot, which has also been observed to flourish in fields bordering roads and consequently exposed to winds laden with lime-containing dust. In moorland soils the disease is often most prevalent in filled-up trenches. Losses of 30 per cent. and more as a result of heart and dry rot were reported in a number of cases, while on certain farms the crop was a total failure.

MELHUS (I. E.), REDDY (C. S.), HENDERSON (W. J.), & VESTAL (E.). **A new virus disease epidemic on Onions.**—*Phytopath.*, xix, 1, pp. 73–77, 1 fig., 1929.

In May, 1928, a new virus disease of Yellow Bottleneck onions was observed in the Pleasant Valley district of Iowa, where a loss of at least 25 per cent. of the crop was sustained.

The symptoms of the disease are very conspicuous. In severe cases the plants are badly stunted and yellow, with crinkled, flat, drooping leaves bearing yellow, longitudinal streaks. The flower

stalks are often chlorotic, bent and twisted, and 6 to 10 inches shorter than normal. These features have suggested the name of 'yellow dwarf' for the new disease.

Numerous observations and experiments have shown that infection is carried in the onion sets and mother bulbs but not in the seed. In six tests, using sets which showed about 10 per cent. infection in the field, the average infection in 600 sets inoculated by injection with 1/10 c.c. of juice from diseased plants was 31 per cent., compared with 7·5 in the controls. These data confirm the supposition that the cause of yellow dwarf is a virus susceptible of artificial transmission from diseased to healthy plants.

TOMSA (K.). **Fusariosní infekce semene Cibule kuchyňské a následná tracheomykosa (chorobné vadnutí).** [*Fusarium* infection of the seed of garden Onion and the ensuing tracheomycosis (pathological wilt).]—*Ochrana Rostlin*, viii, 4, pp. 73–79; 5, pp. 105–112, 4 figs., 1928. [French summary.]

Onion seed of the varieties Vertus and Géant de Zittau imported from France was examined by the author following complaints of its failure in 1928 in Czecho-Slovakia, and was found to be heavily infected internally with a species of *Fusarium*, which was readily isolated as it usually occurred alone or with only a slight admixture of bacteria. The organism agreed fairly well in its morphological and cultural characters [which are described] with *F. cepae* (Hanzawa) emend. Walker and Tims, the cause of a bulb rot of onion in the United States [*R.A.M.*, iv, p. 202], the chief difference being the greater width of the conidia, which comes nearer to that indicated in Hanzawa's original diagnosis.

Macroscopically the infected seed did not differ from the normal; its germinability was unimpaired or even slightly stimulated. Within a short time, however, a white or faintly pinkish aerial mycelium developed both on the germinating and ungerminated seeds, the internal nature of the infection being demonstrated by the fact that the mycelium developed even after the seed had been treated for 3 minutes in a 0·1 per cent. solution of mercuric chloride. When sown in pots containing sterilized crushed brick dust, the seed gave a satisfactory percentage of germination; at first the seedlings grew well, but within a month from sowing the majority developed a characteristic tracheomycotic wilt, and they eventually perished. Of the two varieties, Vertus was attacked most heavily in these trials.

As far as the author is aware, this is the first record of *Fusarium* infection of onion seed, and of a subsequent trachemycosis of the seedlings, these being, in his opinion, two stages of a systemic infection of the whole onion plant, similar to what occurs in *Fusarium* diseases of cereals [cf. ibid., i, p. 56; iii, p. 202]. He considers that the infection of the seed depends largely on the weather conditions during the flowering period and that immediately following. A few samples of onion seed grown in Czecho-Slovakia were also found infected, although to a much lesser degree, with the same organism.

Laboratory experiments indicated that some measure of control may be obtained by steeping the seed for 30 minutes in a 0·2 per cent. solution of mercuric chloride. Germisan and uspulun-universal proved to be much less effective.

DORAN (W. L.) & GUBA (E. F.). **Blight and leaf-spot of Carrot in Massachusetts.**—*Massachusetts Agric. Exper. Stat. Bull.* 245, pp. 271–278, 1928.

Carrot blight and leaf spot, caused, respectively, by *Macrosporium carotae* and *Cercospora apii* [var.] *carotae*, usually occur together in Massachusetts, where they may cause moderate to heavy losses on the late crop in exceptionally rainy summers.

The spores of *M. carotae* were found to germinate well at all temperatures between 61° and 82° F., with an optimum between 72° and 75°. The optimum temperature for the germination of *C. apii* var. *carotae* is 75° to 78°. The incubation period for *M. carotae* is about 14 days, compared with 8 or 9 for the other fungus. Abundant moisture is absolutely essential to the spore germination in both organisms. Infection by *M. carotae* is almost exclusively confined to old leaves, and inoculation experiments on parsnip, celery, and parsley failed. The spores of both fungi were found to overwinter in the soil, but are apparently not seed-borne. Both were found on wild carrots, which are common weeds in Massachusetts.

The results of laboratory and field tests showed that both *M. carotae* and *C. apii* var. *carotae* are highly sensitive to the action of copper [*R.A.M.*, vi, p. 176], the germination of the former being inhibited by Bordeaux mixture at a strength of 2–2–50 and that of the latter at 1–1–50. Except in very wet seasons, however, spraying for the control of these fungi is not considered necessary. Dusting with sulphur failed to prevent the germination of the spores of *M. carotae*.

PORTER (R. H.). **Reaction of Chinese Cucumbers to mosaic.**—Abs. in *Phytopath.*, xix, 1, pp. 85–86, 1929.

In the summer of 1928 an occasional specimen of the Chinese Long cucumber from Nanking developed an almost imperceptible mottling on inoculation with the mosaic virus from the Chicago Special variety. Attempts to transfer the virus from such plants to susceptible American varieties gave positive results in 80 to 100 per cent. of the cases. Some of the Chinese cucumbers later developed a marked crinkling of the terminal leaves, and transfers from these plants to the American varieties demonstrated the presence of the mosaic virus. None of the Chinese plants exhibited the 'white pickle' or stunting common in American varieties, and not more than 15 per cent. showed either mottling or crinkling of the foliage. The mosaic symptoms disappear within 5 to 15 days on the Chinese cucumbers.

CLAYTON (E. E.). **Breeding for resistance to Cucumber mosaic disease.**—Abs. in *Phytopath.*, xix, 1, p. 85, 1929.

The results of four years' experiments in the selection of mosaic-resistant cucumbers on Long Island are stated to be very encouraging. The development of resistant strains from among the standard pickling and slicing varieties in commercial use appears to be quite practicable.

DRECHSLER (C.). **A fruit rot of honey dew Melons due to a species of Phytophthora.**—Abs. in *Phytopath.*, xix, 1, p. 85, 1929.

A species of *Phytophthora*, characterized by prominently papillate zoosporangia averaging 57 μ in length and 30 μ in diameter, was isolated in 1926 from the decayed tissue of a honeydew melon (*Cucumis melo* var. *inodorus*), the exterior of which showed an extensive, sunken, water-soaked area. Inoculation experiments with this fungus on healthy fruits gave positive results.

RAVAZ (L.) & VERGE (G.). **La Vigne en 1926. Maladies, accidents divers, coulure, sécheresse, &c.** [The Vine in 1926. Diseases, various accidents, coulure, drought, &c.].—*Prog. Agric. et Vitic.*, lxxxix, 25, pp. 603–607 ; xc, 37, pp. 260–262 ; 38, pp. 282–286 ; 39, pp. 308–311, 2 figs., 2 graphs, 1928.

The information contained in these articles has already been noticed from another source [*R.A.M.*, vii, p. 359].

HOCKEY (J. F.). **Report of the Dominion Laboratory of Plant Pathology, Kentville, N.S.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 139–156, 6 figs., 1928.

Further investigations into the seasonal development of apple scab (*Venturia inaequalis*) [*R.A.M.*, vii, p. 299] conducted in 1927 at Kentville, Nova Scotia, showed that the first spore discharge was recorded on 28th April, when 1·5 in. of rain fell; this was earlier than the initial discharge in the two preceding years. On 13th May, when 0·81 in. of rain fell, a heavy discharge took place, this being the first general one from the majority of perithecia; immediately prior to this, mature spores were found in all collections from widely scattered areas in the Annapolis valley. On 26th May, the heaviest discharge of the season took place; by this date, when the trees were in the blossom-pink stage, the first visible leaf infections from ascospores were noted, infection of the calyces also being present. At full bloom (about 5th June), another moderate spore discharge was recorded. The heaviest ascospore ejections occurred on days when the mean temperature was below 46° F., and the lightest when it was above 60°; perithecial development and spore formation were greatest at about 50°. At harvest time the trees which had been sprayed before 13th May showed 2·5 per cent. old scab spots on the fruit, while those sprayed between this date and 26th May averaged 12 to 25 per cent., indicating the necessity of spraying before the first heavy ascospore discharge.

The age of the leaf and the time of shedding in the previous autumn appeared to have less effect on perithecial formation than did the prevailing temperature and rainfall during the winter and early spring.

In November, 1926, in order to test the value of spraying the trees immediately after harvest, several twigs were given heavy applications of 1 per cent. copper sulphate and their leaves collected and kept under observation on the ground; in April, 1927, both the sprayed and control leaves showed normal perithecial develop-

ment, and subsequently discharged mature ascospores. Notes are also given on the effect of various chemicals on ascospore formation and on the spraying and dusting practices in Nova Scotian apple orchards.

The report also contains observations on the control of currant rust (*Cronartium ribicola*), and on the production of turnips resistant to club-root (*Plasmodiophora brassicae*).

BERKELEY (G. H.). **Report of the Dominion Laboratory of Plant Pathology, St. Catherines, Ontario.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 121–139, 7 figs., 1928.

This report, which is on the same lines as those issued in previous years [cf. *R.A.M.*, vii, p. 300] contains, among others, the following items of phytopathological interest.

An epidemic of cherry leaf spot (*Coccomyces hiemalis*) caused serious defoliation during 1927 in Ontario in unsprayed orchards; the fruit and pedicels were also severely attacked. Where the recommended spray schedule was applied the trees were only slightly affected.

To ascertain the value of a pre-blossom spray in controlling blossom blight of peaches [*Sclerotinia americana*: *R.A.M.*, viii, pp. 253, 254] two rows of Admiral Dewey peaches were sprayed with wettable sulphur when the blossom buds were pink, two other rows being left unsprayed. The sprayed rows remained almost entirely unaffected, although the controls showed considerable blossom blight and die-back.

The results of a third year's picking on an experimental plot containing 30 healthy and 30 mosaic raspberry bushes showed that the former produced 13,486 berries, or 556 oz., as compared with only 10,888 berries, or 398 oz., from the mosaic bushes. The disease spread most rapidly in the Marlboro, Viking, and King varieties; no spread whatever took place during three years in the Herbert, Adams 87, Newman 23, and Count varieties.

Strawberry root rot was severe in June, diseased plants being present in nearly every patch examined. Most of the isolations made yielded either bacteria, or species of *Fusarium* and *Ramularia*, or a sterile mycelium of the *Rhizoctonia* type. Artificial inoculations gave positive results only with the last-named. In the spring of 1925, a strawberry plantation showed pronounced mosaic-like symptoms; the Eaton variety was about 100 per cent. affected, though the adjacent Cooper and Premier strawberries were still healthy. Field observations indicate that the disease is systemic, and no plant was observed to recover. It was present on drained and undrained land and on all types of soil. The chief symptoms (which are somewhat masked in hot weather) consisted in a yellowing of the unfolding leaves; a definite yellowish-green to green, streak-like mottling of the foliage, the older leaves showing greyish-white areas, especially round the margin; frequent puckering and lengthwise curling of leaf blades; uneven formation of the leaves (i.e., one of the lateral leaf-lobes greatly reduced in size in comparison with the other); and general stunting of all

parts of the plant. The Eaton variety also showed a reduced number of blossoms, though producing fair crops, while some of the badly diseased Waites Perfection plants gave practically no crop in the second year of attack. In one plantation of this variety 50 per cent. of the plants gave no crop after three years. One hundred and fifty aphid transfer inoculations of healthy Eaton strawberry plants were made from mosaic leaves; the following season all the inoculated plants showed the disease.

ROBERTSON (H. F.). **Annual Report of the Mycologist, Burma, for the year ended 30th June, 1928.**—Rangoon, Supdt. Govt. Printing and Stationery, Burma, 10 pp., 1928.

During the period under review a species of *Nematospora* was found on stored beans (*Phaseolus* sp.). Rust (*Kuehneola gossypii*) [*K. desmium*] caused severe defoliation of Cambodia cotton in one locality.

The 'sugary disease' (*Sphacelia sorghi* McRae) of sorghum was very prevalent and severe in Mandalay, Padu, and other localities, though mostly confined to the Kunpyaung fodder type [cf. *R.A.M.*, vi, p. 91]. Long, hard, horn-like sclerotia may ultimately be produced from infected grains. *S. sorghi* is generally accompanied by *Cerebella sorghi-vulgaris*, which grows on the exudate and may to some extent check the development of the sclerotia. *Panicum prostratum* growing in the vicinity also showed the presence of a *Sphacelia* and a *Cerebella*.

Smut (*Sphacelotheca sorghi*) in the Kunpyaung type of sorghum was reduced from 16 to 0·5 per cent. without injury to the grain by steeping for 30 mins. in 2 per cent. copper sulphate solution; this period is accordingly recommended instead of 15 mins. as heretofore [ibid., vii, p. 559].

The so-called 'pothe' or 'green flowering' disease of *Sesamum* [*indicum*] was exceptionally severe in the Sagaing and Lower Chinwin Districts, where up to 90 per cent. of the plants were affected; at Tatkôn the disease was milder. Almost all the local varieties of sesame are affected. The symptoms become noticeable only at the flowering stage, when the floral parts are transformed into green, leaf-like structures and branching is abnormally abundant. Affected plants seldom fruit. The disease is stated to be most severe during prolonged drought or when sowing is very early. Several other plants showing similar symptoms have been observed.

A severe, unidentified affection of *Hevea* rubber bark was reported from the vicinity of Wanetchaung; on some trees the bark had cracked longitudinally and on others it had scaled off. The renewed bark was dark red and very moist. Untapped trees were also affected. No fungus was found to which the damage could be attributed.

Studies of 12 different strains of rice soil fungi, mostly species of *Aspergillus* and *Penicillium*, showed that these liberate large quantities of ammonia in the presence of air (without air the production is slight), and that two of these fungi in combination produce more ammonia than either singly [cf. ibid., viii, p. 334].

Stell (F.). **Plant pathology.**—*Admin. Rept. Dept. Agric. Trinidad & Tobago for the year 1927*, pp. 33–36, 1929.

During 1927, a slight extension of the mosaic disease of sugarcane in Trinidad was reported; at the experiment station infection was reduced by weekly roguing from 0·0532 per cent. in 1926 to 0·0118 per cent. in 1927.

Root diseases of cacao (*Rosellinia* and *Sphaerostilbe* spp.) affect some of the most productive trees, as these grow on soil rich in organic matter where such organisms thrive. Thread blight (*Corticium* sp.) was unusually widespread on this crop owing to the prevailing humidity, but is of economic importance only in excessively moist, shaded localities.

Little leaf of coco-nuts [*R.A.M.*, vii, p. 305] was conspicuous in some districts. A dilute disinfectant should be copiously applied to the crowns, after cutting the strainers. Thread blight was found on the leaves of one coco-nut in a wet district. A disease of the leaf-bitten type [cf. ibid., vii, p. 629], caused by *Phytophthora* [*palmivora*], was present on one estate, in which also some of the crowns were in an advanced stage of collapse.

Thread blight of coffee (*Pellicularia* [*Corticium*] *koleroga*) was noticeably prevalent in wet, excessively shaded areas.

Division of Plant Pathology.—*Thirty-eighth Ann. Rept. Washington Agric. Exper. Stat. for the fiscal year ended June 30, 1928* (*Bull.* 229), pp. 38–41, 1928. [Received March, 1929.]

Neither formaldehyde dust nor iodine dust gave satisfactory control of wheat bunt caused by *Tilletia tritici* and *T. levis*. Three different copper carbonate dusts, containing 18 to 20 per cent. of metallic copper, gave practically as good control as pure copper carbonate, the degree of infection ranging from 0 to 3 per cent., compared with 34 to 76 per cent. in the controls [*R.A.M.*, vii, p. 363]. Infection was completely eliminated by copper oxalate dust at the rate of 2 oz. per bushel.

The following are some of the diseases occurring for the first time in the State, or with unusual severity. Wilt or stem rot of lucerne (*Sclerotinia trifoliorum*) was reported from new localities to an increasing extent. Aster wilt (*Fusarium conglutinans* [var.] *callistephi*) caused the almost total failure of certain varieties, e.g., Queen of the Market. *Ustilago bromivora* was very prevalent on common cheat grass (*Bromus tectorum*), suggesting the possibility of its use to check the spread of this weed. Gladiolus mosaic [ibid., vii, p. 517] is reported to be on the increase. Lilac was attacked in three different localities by *Pseudomonas syringae* [ibid., vii, p. 515].

A destructive disease of field peas, associated with the presence of *Rhizoctonia* sp. and *Fusarium* sp., was widespread in eastern Washington, causing losses of up to 50 per cent.

The Grand Rapids disease of tomato (*Aplanobacter michiganense*) [ibid., vii, p. 680] has been reported in a relatively mild form from localities west of the Cascades.

The virus diseases of strawberries and brambles [*Rubus* spp.] are increasing in importance and require special attention [cf. ibid., viii, p. 295].

Department of Botany and Plant Pathology.—*Oregon Agric. Exper. Stat. Director's Bienn. Rept. 1926–1928*, pp. 97–101, 1928.

Rugose mosaic remains the most serious and common virus disease of potatoes in Oregon [*R.A.M.*, viii, p. 294]; leaf roll causes similarly heavy losses in affected plants but is less prevalent. As a result of very careful roguing, rugose mosaic in one lot of potatoes was gradually reduced from 4·5 per cent. in 1925 to 0·4 per cent. in 1928.

Proof is stated to have been obtained that 'breaking' of tulips [ibid., viii, p. 311] is an infectious mosaic disease; it was transferred from 15 varieties of broken tulips, including four commercial Rembrandts and one or more representatives of the Cottage, Breeder, and Darwin types, to one variety, Clara Butt, and from this in turn to 17 other varieties, resulting in the production of a similar type of disease in all. The methods used for transmission were leaf mutilation, which gave 30 per cent. infection, tissue graft (33 per cent. infection), and aphid transfer (12 per cent. infection). The aphid *Macrosiphum solanifolii* [*M. gei*] transferred the disease to 24 per cent. of the plants, while other species, including *Myzus persicae* and *M. pelargonii* gave relatively low percentages of transmission.

Mosaic caused very appreciable damage to some stocks of commercial iris; the disease weakens growth and flowering.

New infections of apples by perennial canker [*Gloeosporium perennans*] have been linked up more definitely with frost injury to tissues made abnormal by insect attack [ibid., vii, p. 328]. Infection takes place through cracks made by low temperatures in tissues rendered spongy by insect attack. Control, therefore, appears to be largely an entomological problem.

The strain of *Verticillium* [*albo-atrum*: ibid., viii, p. 295] isolated from black raspberry [*Rubus occidentalis*] was more virulent on this host than was the strain isolated from potato.

Investigations are in progress into a root rot of strawberries on the western slopes of the Cascade mountains and in the Willamette Valley; plantings showing from 1 to 100 per cent. infection have been found.

Plant diseases.—*Ann. Rept. Nebraska Agric. Exper. Stat.*, pp. 23–27, 1927. [Abs. in *Exper. Stat. Record*, lix, 9, pp. 840–841, 1928.]

Collections of stem rust (*Puccinia graminis*) from 55 counties in Nebraska comprised six physiologic forms. Infected barberries normally bear pycnidia between the 20th and 26th April and mature aecidiospores between 6th and 10th May, the uredosori appearing on cereals and grasses from about 20th to 25th May. The first uredosori not associated with barberries were observed in south-eastern Nebraska during the first week in June, and two weeks later in the western districts.

Much of what was formerly regarded as potato spindle tuber [*R.A.M.*, vii, p. 463] has now been identified as unmottled curly dwarf. A distinct correlation was established between the length of time that the spindle tuber plants remained in the fields and the

amount and severity of the disease in the ensuing crop. The virus of mild mosaic and yellow top [ibid., vii, p. 110] was destroyed by temperatures above 50° C; it was readily transmitted by knives and also by insects, especially grasshoppers. In tuber-index work [ibid., iv, p. 656] with selected Triumph strains the mosaic content was reduced to less than 0·2 per cent. as compared with 38·2 per cent. in the original lot. Hollow heart of potatoes was most prevalent on plants with few stems, in large tubers, in spindle tubers, and in tubers showing second growth or growth cracks.

North Dakota Agricultural Experiment Station Bulletin 217, 1928.—[Abs. in *Exper. Stat. Record*, lix, 9, pp. 841–842, 1928.]

In the section of this bulletin dealing with botany (pp. 52–55) by H. L. Bolley *et al.*, it is stated that plant-breeding experiments for resistance to flax wilt [*Fusarium lini*: *R.A.M.*, vi, p. 357] have resulted in the production of large-seeded, heavier-yielding strains which are as resistant as the smaller-seeded type. Bison, a new resistant variety, yielded 25·13 bushels of seed, with an oil content of 42·37 per cent., as compared with 17·72 bushels and 38·67 per cent. oil content in the variety N.D. 114.

Sulphur dusting for the control of wheat rust [*Puccinia graminis* and *P. triticina*] gave increased yields of from 0·45 to 8·62 bushels per acre.

In experiments on the control of potato scab [*Actinomyces scabies*] and *Rhizoctonia* [*Corticium solani*] it was found that the water used in making the solution often precipitated much of the mercuric chloride; fresh rain water is recommended, or 5 oz. mercuric chloride should be used to 30 galls. of any alkaline water that precipitates the mercury.

In the section of plant pathology (by W. E. Brentzel) it is stated that formaldehyde and abavit B solutions gave better control of *Helminthosporium sativum* than did dry copper carbonate. Both *Tilletia tritici* and *T. levis* were found on common and durum wheats in North Dakota. When potatoes were treated with mercuric chloride for the control of scab the crop produced 98 per cent. of clean tubers, as compared with 84 per cent. for the hot formaldehyde treatment.

Muncie (J. H.) & Patel (M. K.). **Potency and specificity of a lytic principle (bacteriophage) obtained from Pseudomonas tumefaciens.**—Abs. in *Phytopath.*, xix, 1, p. 98, 1929.

A lytic principle has been obtained from a pure culture of *Pseudomonas* [*Bacterium*] *tumefaciens* (V) and also from an artificially induced gall on sugar beet (III). The potency of the lytic principle has been increased until, after 17 filtrations, 'phage' V at a dilution of 10^{-14} and 'phage' III at 10^{-10} dilution cause lysis of a 24-hour-old broth culture of *Bact. tumefaciens* [*R.A.M.*, v, p. 657; vii, p. 564]. Cultures of *Bact. tumefaciens* failed to infect tomato plants after being subjected to the action of the bacteriophage for nine hours. The lytic principle survives ten minutes' heating at 80° C. but is inactivated at 85°. When tested against 20 strains of *Bact. tumefaciens* (from various hosts), and eight other plant

pathogens, 'phage' V was found to be specific in its lytic action, affecting only the strain of the crown gall organism from which it was derived.

RIKER (A. J.). **Studies on the influence of environment on infection by certain bacterial plant parasites.**—Abs. in *Phytopath.*, xix, 1, p. 96, 1929.

In certain diseases where the pathogen penetrates the host through natural openings, the moisture condition of the plant before inoculation has been found very important in relation to the amount of infection secured. Plants placed in a moist chamber for a day previous to inoculation with *Bacterium lacrymans*, *Bact. pisi*, and *Bact. tabacum*, and replaced in the moist chamber, developed many more lesions than those subjected to humid conditions only after inoculation. Temperature was also found to be an important factor in the development of infection, the optimum being 24° C. for *Bact. lacrymans*, 28° for *Bact. tabacum*, 12° for *Bact. holci*, 28° for *Bact. coronafaciens*, and 28° for *Aplanobacter michiganense.* In certain cases newly expanded leaves were found to develop more lesions than older ones.

HOCQUETTE (M.). **Une nouvelle maladie du Blé dans le nord de la France : le 'black chaff'.** [A new Wheat disease in the north of France: the 'black chaff'.]—*Comptes rendus Soc. de Biol.*, c, 4, pp. 270–271, 1929.

In July, 1928, the writer observed that certain wheat varieties (especially the early C.D.) at Cappelle (Nord), were attacked by black chaff (*Bacterium translucens* var. *undulosum*) [*R.A.M.*, viii, p. 228]. The leaves of the affected plants showed yellowish stripes, brownish or black patches occurred on the culms and rachides, and blackish parallel streaks or elongated, slightly depressed spots developed on the glumes. A brief description of the disease, based on American researches, is given.

SANFORD (G. B.). **Report of the Dominion Laboratory of Plant Pathology for Alberta.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 112–115, 1 map, 1928.

Notes are given on the prevalence and distribution of diseases of cereals in Alberta observed during the first systematic plant disease survey of the province, made in 1927. The diseases recorded include the common rusts and smuts, *Septoria glumarum*, *Bacterium atrofaciens*, *Bact. translucens*, and foot and root rots (*Ophiobolus graminis*, *H. sativum*, and *Fusarium* spp.) [*R.A.M.*, vii, pp. 301, 312], on wheat.

Wheat stem rust (*Puccinia graminis*) was first observed about the middle of August, and by 27th September it was found in every field from the northern limit of the survey, at Westlock and Athabasca, as far south as the Montana boundary.

The foot and root rots of wheat, which remain the outstanding problem of plant disease in Alberta, appear to be closely correlated with different types of soil; they were most prevalent on black soil with a high organic content, while take-all [*O. graminis*]

decreased distinctly as the brown prairie types of soil were encountered, and in the strictly brown soils no appreciable foot rot of any kind was observed.

In 1927 the average loss from foot and root rots of wheat, principally take-all, in Alberta was about 10 per cent., losses in individual crops ranging from 1 to 90 per cent. If the average loss is applied to one-third of the total yield it approximates to 7,000,000 bushels, which is considered to be a very conservative estimate of the damage done by these diseases.

BAILEY (D. L.). **Report of the Dominion Rust Research Laboratory, Winnipeg, Man.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 47–54, 1928.

Epidemiology studies [conducted by J. H. Craigie and W. Popp: cf. *R.A.M.*, vii, p. 309] showed that in 1927 the first traces of wheat stem rust [*Puccinia graminis*] were found at Winnipeg and Morden, Manitoba, on 6th July; by 18th July light infection was general in Manitoba as far north as Winnipeg, and also throughout Saskatchewan. After hot weather from 23rd to 27th July, and again after 9th August, infection spread to an alarming extent and led to one of the worst rust epidemics known in Canada. In Alberta, although near Camrose infection amounted to 60 per cent., the loss generally was negligible owing to the failure of the spores to arrive early enough and in sufficient numbers (the prevailing wind is not usually east or south-east). Infections were found for the first time as far north as Beaver Lodge.

Stem rust of oats [*P. graminis avenae*], previously not very prevalent in the Western Provinces, reached epidemic proportions except in south-western Saskatchewan and Alberta.

Wheat leaf rust (*P. triticina*) appeared in southern Manitoba and south-eastern Saskatchewan during the third week in June and by the middle of July was causing much damage.

Crown rust of oats (*P. coronata*) was prevalent and intense; by 15th July it was abundant throughout southern Manitoba and was not, as in previous years, confined to the vicinity of buckthorn hedges [*Rhamnus cathartica*].

Traces of yellow rust (*P. glumarum*) were found over an area stretching in Alberta as far south as the international boundary, and also at Robsart, Saskatchewan.

The tremendous loss sustained is indicated by the fact that of 152,210 ears of wheat inspected in the Western Division up to 11th December, 1927, only 35 per cent. were graded No. 3 Northern or higher, as compared with 55 per cent. so graded in 1926; 37 per cent. were marked 'no grade'.

Stationary slide exposures and aeroplane spore traps [the data obtained with which are tabulated and fully discussed] indicated that rust spores were general in the air over south-eastern Saskatchewan and southern Manitoba during June in sufficient numbers to produce the first field infections; it is considered that these spores did not originate in Canada. Shortly after 18th July, the spore content of the air increased appreciably, owing partly to spores originating north of the international boundary and partly

to others being blown in from Dakota and Minnesota, where a severe epidemic of rust had developed. The spores found about the end of July and the middle of August at Beaver Lodge are considered to have probably come from Saskatchewan. The data obtained are considered to indicate the important part played by wind-borne spores in the dissemination of rust in western Canada.

The marked effect of continuous rainfall in clearing the air of rust spores was shown by the fact that although epidemic conditions prevailed in the fields, the spore concentration in the air at northerly points in Manitoba and Saskatchewan during August and early September was comparatively low except for short periods after drought or southerly winds.

GASSNER (G.) & STRAIB (W.). **Untersuchungen über die Infektionsbedingungen von Puccinia glumarum und Puccinia graminis.** [Investigations on the infection conditions of *Puccinia glumarum* and *Puccinia graminis.*]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xvi, 4, pp. 609–629, 1928. [Issued 1929.]

This is a continuation of the first-named writer's investigations (in collaboration with Appel) on the factors influencing infection by various cereal rusts [*R.A.M.*, vii, p. 82].

The technique of the inoculation experiments is fully described, and the results tabulated and discussed. *Puccinia glumarum* f. sp. *tritici* was found to be much more susceptible to external conditions than the other rusts tested. Thus, four hours' exposure to direct sunlight at 30° to 35° C. practically destroyed the viability of the yellow rust spores, whereas those of *P. triticina*, *P. dispersa*, and *P. coronifera* [*P. lolii*] were unaffected. The inoculum for the tests was, therefore, derived from plants grown in the shade at a relatively low temperature. The experiments were carried out on ten- to twelve-day-old seedlings of Heine's smooth Teverson and Hörning's Dickkopf wheat kept for varying periods (up to eight days) under bell jars at 100 per cent. humidity, and then transferred to open shelves in the greenhouse at 60 to 90 per cent. humidity. In the case of fresh inoculum, a period of 24 hours in a saturated atmosphere was sufficient to ensure infection, but during the winter two or three days under the bell jar were requisite for this purpose. Prolonged retention (four to eight days) in a saturated atmosphere after inoculation reduced the number of successful infections whether judged by the development of yellow spots or by pustule formation. Inoculation was facilitated by the removal of the wax layer from the leaf surfaces, thereby increasing transpiration. The optimum temperature for the development of yellow rust on Heine's Teverson seedlings was found to be below 20°, immediately above which point the incubation period was prolonged by two days. The incidence of infection by *P. glumarum* f. sp. *tritici* was greatly reduced by the partial or total absence of light.

P. graminis f. sp. *tritici* was found to be relatively resistant to direct sunlight and to the protracted action of high temperatures (30° to 35°). A period of eighteen hours in a saturated atmosphere sufficed to ensure infection by this species, which was not,

however, adversely affected by retention under the bell jar for eight days or more after inoculation. The optimum temperature for the development of *P. graminis* f. sp. *tritici* was found to be 17° to 20° with a maximum at 30°. Like the other species tested this fungus also was adversely affected by a reduction of light.

Roussakoff (L. F.) & Shitikova-Roussakova (Mme A.). Зимовка ржавчины на озимых в Дальне-Восточном крае по данным за **1926** год. [Overwintering of rusts on autumn-sown cereals in the Far East according to the data of 1926.]—*Известия Приморской Обл. Сельско-Хоз. Опыт. Станции.* [*Primorskaya Regional Agric. Exper. Stat. News*], Nikolsk-Ussuriisk, *1928*, 10, pp. 196–217, 1928.

Field observations made in the spring of 1926, in continuation of the authors' study of the epidemiology of cereal rusts in the Russian Far East [*R.A.M.*, vii, pp. 232, 233], showed that in the Primorskaya [Pacific Littoral of Siberia] Region the leaf rust of rye (*Puccinia dispersa*) may overwinter on autumn-sown crops wherever these are cultivated, as does also the leaf rust of wheat (*P. triticina*), though to a lesser extent. The conditions necessary for their overwintering are a sufficiently moist and warm autumn, a deep and uninterrupted snow cover of long duration during the winter, and the absence of sharp fluctuations in temperature and snowfall in the early spring. Both rusts appear to overwinter best on gently sloping hillsides sheltered from the predominant winds, and slight soil depressions also apparently favoured successful survival. For the latter reason cattle grazing in the autumn on the winter crops is discountenanced, as most of the plants growing in the cattle spoors were found to be heavily infected in the spring. In general, a marked direct correlation was established between successful overwintering of the rye and wheat plants and that of the rusts. Wheat stem rust (*P. graminis tritici*) was not found overwintering on the autumn-sown crops in any of the fields examined.

Roussakoff (L. F.) & Pantchenko (M. F.). Поражение **1290** чистых линий Пшениц стеблевой ржавчиной и понятие об иммунитете во времени. [Infection of 1290 pure lines of Wheat with stem rust and conception of immunity in time.]—*Известия Приморской Обл. Сельско-Хоз. Опыт. Станции.* [*Primorskaya Regional Agric. Exper. Stat. News*], Nikolsk-Ussuriisk, *1928*, 10, pp. 181–195, 1 fig., 1 graph, 1928.

The experiments briefly described in this paper were conducted in 1926 at the Primorskaya Regional Agricultural Experiment Station for the purpose of testing locally grown varieties of wheat for immunity from, or resistance to, stem rust (*Puccinia graminis tritici*). In all, 1290 pure lines of *Triticum vulgare* vars. *erythrospermum*, *lutescens*, and *ferrugineum* were sown on 12th May, about a fortnight later than usual in the region (in order to promote heavy infection), and notes were taken on the development of the rust, towards the end of ear formation, and at the beginning

and end of the milky maturity stage of the grain. The year proved to be one of widespread and heavy rust infection, thus enhancing the reliability of the tests.

The pure lines of the local Strube strain of *erythrospermum* (morphologically indistinguishable from the original Silesian strain of the same name) stood out strikingly from all the others, in that at the first observation 99 per cent. were entirely free from rust, while the average incidence and intensity of infection of the remaining lines was equal to 2 to $2\frac{1}{2}$, with a maximum of 3 to $3\frac{3}{4}$, of the 5 marks scale [*R.A.M.*, ii, p. 158; vii, p. 770]. A week after the setting in of the milky maturity stage, the average intensity of infection of the majority of the Strube lines was 1 to $1\frac{1}{2}$ (some 50 lines being still practically free from rust), with a maximum of $2\frac{1}{2}$ to 3, while that of all the other lines ranged from $3\frac{1}{4}$ to $3\frac{1}{2}$ with a maximum of 4. At the end of the milky maturity stage, the marks for the Strube lines had risen to an average of 3, with a maximum of $3\frac{1}{4}$ to $3\frac{1}{2}$, while those for the other varieties were $3\frac{1}{2}$ to $3\frac{3}{4}$ and 4, respectively.

These findings lead the authors to the conception of immunity in time which, in contradistinction to absolute immunity, is exhibited by immunity from infection only until the setting in of certain, determined phases in the development of the host plant—in the case of the Strube pure lines, until ear formation, the milky maturity stage, and the last few days of vegetation. This conception is of considerable practical importance in the selection of resistant varieties, since a very marked correlation was found between the date at which the first pustules appeared on a given line and the relative weight of the resulting grain, earlier infection implying a correspondingly greater loss in weight. This new criterion allowed the author to select 42 pure lines which were comparatively mildly infected and which yielded grain weighing more than 21 gm. per 1000 (the normal standard for the region), and 14 lines which, although heavily infected, gave grain weighing over 23 gm. Of these comparatively resistant lines, yielding grain of satisfactory weight, 26 belonged to *T. vulgare* var. *erythrospermum*, 11 to *lutescens*, and 5 to *ferrugineum*.

HYNES (H. J.). **Stem rust of Wheat. The isolation of resistant types from a Federation × Khapli cross.**—*Agric. Gaz. New South Wales*, xxxix, 12, pp. 871-880, 1 pl., 1928.

A study of the agronomic qualities and reaction to the Australian forms 1 and 2 of stem rust (*Puccinia graminis tritici*) of certain families of the F_4 to F_6 generations of the cross made by the author in 1921 between Federation wheat (*Triticum vulgare*) and Khapli emmer (*T. dicoccum*) [*R.A.M.*, vi, p. 153] showed that out of 394 F_5 families, nine were completely resistant to form 1, while also possessing desirable field characters. Out of 549 F_6 families, sixteen possessed numerous individuals resistant to both forms of rust, and of these, seven showed promising agronomic characters; four F_6 families were completely resistant (no plants with more than types 1 and 2 [ibid., ii, p. 158] of infection) to both forms and also possessed desirable field qualities.

LAMBERT (E. B.). **The relation of weather to the development of stem rust in the Mississippi Valley.**—*Phytopath.*, xix, 1, pp. 1–71, 2 diags., 9 graphs, 1929.

During five years' investigations on the relation between weather conditions and the incidence of stem rust of cereals (*Puccinia graminis*) in the Mississippi Valley [cf. *R.A.M.*, vii, p. 432], the writer found that the teleutospores lose their viability if kept for several months at a high temperature (35° C.). Possibly this fact may explain the absence of rust on barberries in the southern States. Such factors as alternate freezing and thawing, wetting and drying, light, and chemical stimuli exercised no appreciable effect on the resting period of the teleutospores, the minimum time for the germination of which was found to be six hours (average time, twelve hours). Germination was found to occur over a fairly wide range of hydrogen-ion concentration (P_H 5·8 to 6·2, 5·2 to 7·8, and 5 to 7 in three different tests). In nature the teleutospores lose their viability a few months after maturity, but in cold storage this may be preserved for nearly a year.

At St. Paul, Minnesota, the teleutospores of *P. graminis* have been found to be viable several weeks before the appearance of the barberry leaves in the spring. Field observations indicate that teleutospores are almost invariably present within a few rods of heavily rusted barberries. The optimum temperature for barberry infection by *P. graminis secalis* was found to be 17° to 18°, little rust developing at 22° to 23° and practically none at 26°. The penetration of barberry leaves is apparently favoured by low light intensity, while the subsequent development of the aecidial stage seems to be promoted by intense light. Some indication has been found of a correlation between the average temperature and rainfall in April and the earliness and severity of barberry infection, this process being facilitated by warm weather and heavy rain. A correlation was further found between warm growing seasons (May to July) and destructive epidemics in the spring wheat area.

The overwintering of the uredospores appears to be limited to regions in which the temperature and rainfall conditions favour the successive development of these bodies at frequent intervals. Periods of alternate freezing and thawing are apparently a limiting factor. In southern Texas, weather conditions during the summer seem to be more important than winter ones in restricting the persistence of the uredo stage. The predominance of stem rust on oats as compared with wheat in northern Texas and Oklahoma in 1926 is attributed to the mild winter of 1925–6, which favoured the growth of volunteer oats.

When rust becomes plentiful throughout one or more fields of grain, it may spread, in appreciable amounts, for several miles to surrounding fields, while there is circumstantial evidence that the spores may be blown several hundred miles from a severely infected area. Southerly winds may sweep up the Mississippi valley during the last ten days in May and the first ten days in June (when stem rust is at its height in the south) with sufficient velocity to carry spores from Texas to the spring wheat area in less than three days. No evidence was obtained, however, of any specific meteorological

condition or set of conditions constantly accompanying stem rust epidemics in this area.

BAILEY (D. L.). **Studies in cereal diseases. IV. Stem rust in Western Canada.**—*Canada Dept. of Agric. Bull.* 106, N.S., 31 pp., 19 figs., 1928.

A general account is given of the cereal-rust situation in Canada summarizing recent work, most of which has already been noticed from other sources. During the last twenty years, stem rust (*Puccinia graminis*) is stated to have caused an annual loss of at least twenty-five million dollars in Manitoba and Saskatchewan. Field studies and studies of the spore content of the air [see above, p. 360] indicated that the first infections are always due to wind-borne spores originating farther south.

Twenty-five physiologic forms of wheat stem rust [see next abstract] and six of that of oats [ibid., viii, p. 96] have been found in Canada; none of the standard wheat varieties is resistant to all the rust forms, and those that show partial resistance are mostly of poor quality. Crosses are being made to develop resistant cereal varieties of high quality.

NEWTON (MARGARET), JOHNSON (T.), & BROWN (A. M.). **New physiologic forms of Puccinia graminis tritici.**—*Scient. Agric.*, ix, 4, pp. 208–215, 1929.

During 1926 and 1927 eight new forms of *Puccinia graminis tritici* were identified in Canada [*R.A.M.*, vii, p. 567]. Four of these forms, viz., 38, 48, 50, and 53, were collected on cereals and grasses (38 on wheat, barley, and *Hordeum jubatum* and the others on wheat only); form 49 on wheat, *H. jubatum, Elymus canadensis*, and barberry; 52 on wheat and barberry; and 56 and 57 on barberry only.

Tables are given showing the locality, date of collection, and hosts of the new forms; their distribution and relative prevalence in the different provinces of Canada; and the average incidence of infection produced by each on twelve differential wheat varieties.

SCHEIBE (A.). **Studien zum Weizenbraunrost, Puccinia triticina Erikss. I. Methoden und Ergebnisse bei der Bestimmung seiner physiologischen Formem (Biotypen).** [Studies on brown rust of Wheat, *Puccinia triticina* Erikss. I. Methods and results in the determination of its physiological forms (biotypes).]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xvi, 4, pp. 575–608, 2 pl., 5 figs., 1 map, 1928. [Issued 1929.]

A detailed account is given of the author's recent investigations on the occurrence in Germany of different physiological forms (biotypes) of brown rust of wheat (*Puccinia triticina*), and of the reaction towards these strains of nearly 300 indigenous and foreign varieties.

Thirteen collections of the rust were obtained from nine different localities in Germany, one in Finland, and one in Esthonia. The inoculation experiments [the technique of which is indicated] were carried out in the greenhouse at a temperature of 20° C., the atmospheric humidity being maintained at 60 to 80 per cent.

Preliminary tests on eleven standard varieties of wheat demonstrated the existence of three new physiological forms of *P. triticina* (xiii to xv) in addition to one of the twelve already determined by Mains and Jackson in the United States [*R.A.M.*, v, p. 477]. Form xi, isolated from six different localities in the south and south-west of Germany and identical with the corresponding American strain, appears to be spreading. Form xv was found only once in material from east Thuringia. Form xiii occurred in the north-eastern and form xiv in the central districts; the former shows a tendency to spread in the north-east similar to that exhibited by form xi in the south-west.

The great majority of the wheat varieties used in these experiments [the results of which are discussed and tabulated] showed a high degree of susceptibility to one or more of the four German physiological forms of *P. triticina*. The spelt varieties were more susceptible than the emmer, while those of the einkorn group were comparatively resistant. Within each group, however, there were wide divergences in the reaction of the different varieties to infection by brown rust. Thus, among the emmers, Kubanka, Mindum, and various strains of Arnautka are highly resistant, while Acme, Monad, Nodak, and Pentad are very susceptible. In the common group, Marquis proved highly susceptible to all four physiological strains of *P. triticina*, while Kota was uniformly resistant. Hybrids derived from crosses between these two varieties combined the desirable characters of Marquis with the resistance of Kota. It was observed that practically all the German wheat selections are highly susceptible to *P. triticina*, indicating the necessity of further experimentation in hybridization with foreign material.

WINKELMANN (A.). **Zur Methodik der Bestimmung des Bestäubungsgrades trockengebeizten Getreides.** [On the technique of the determination of the amount of material carried on dusted seed-grain.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, ix, 1, pp. 3–5, 1929.

The writer found that the amount of material carried on dusted seed-grain could be determined, in the case of tillantin, by a simple colorimetric method, whereby samples of seed-grain taken from the dusting apparatus are compared with similar samples treated with standardized quantities of the disinfectant. With tillantin R and abavit B, however, it was found necessary to add a finely powdered dye. Ponceau red and methyl red, used at the rate of 10 and 8 gm., respectively, per kg. of dust, were found to be the most suitable of the 15 substances tested for this purpose. Tillantin R also reacted to the admixture of a weak acid or alkali by the development of a greenish or brownish colour, respectively.

TISDALE (W. H.) & CANNON (W. N.). **Ethyl mercury chloride as a seed grain disinfectant.**—Abs. in *Phytopath.*, xix, 1, p. 80, 1929.

Preliminary tests in the control of wheat bunt [*Tilletia tritici* and *T. levis*], covered smut and stripe of barley [*Ustilago hordei*

and *Helminthosporium gramineum*], loose smut of Tennessee winter barley [*U. nuda*], oat smuts [*U. avenae* and *U. levis*], and covered kernel smut of sorghum [*Sphacelotheca sorghi*] with 1·5 per cent. ethyl mercury chloride dust are stated to have given very promising results.

HURST (R. R.). **Control of Wheat smut (Ustilago tritici (Pers.) Jens.) in the Huron variety, at Charlottetown, P.E.I.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 116–117, 1928.

The modified hot water treatment having failed to control *Ustilago tritici* on Huron wheat at Charlottetown, further tests were conducted in which it was found that seed viability in this variety was not seriously impaired when the seed was soaked for 20 minutes in water at 54° C., with a presoak of 3 hours at 20°, the smut incidence after this treatment being less than 1 per cent. as compared with 6 per cent. in the untreated controls and 3 per cent. in Huron seed treated at lower temperatures.

It is therefore recommended that Huron seed should receive a presoak at 20° for 3 hours, an intermediate soak at 43° for 20 minutes, and a final soak at 54° for 20 minutes.

PETIT (A.). **Traitement de la carie du Blé au moyen de faibles doses de cuivre. Résultats d'une étude systématique.** [The treatment of bunt of Wheat by means of weak doses of copper. The results of a systematic study.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 8, pp. 238–248, 1928.

In this paper the author describes the conclusions resulting from several years' investigations into the efficacy of a large number of disinfectants of wheat seed-grain against bunt (*Tilletia tritici* and *T. levis*). He considers that, in view of the greater economy effected by using dusts, these should replace liquid treatments.

The disinfectant properties of a large number of salts of various metals were tested by methods which are indicated and which will be published in greater detail in due course. Salts of mercury and copper generally gave the best results, and, in particular, the author's experiments are stated to have demonstrated that heavily contaminated grain containing 5 gm. of spores per kg., can be thoroughly sterilized by dusting at the rate of 250 gm. per quintal either with cuprous chloride or with a mixture of talc and 22 per cent. of cupric chloride, i. e., one containing 20 gm. metallic copper [*R.A.M.*, vii, p. 500]. Grain with an average amount of contamination (1 gm. of spores per kg.) can be adequately disinfected by using the same quantity of a cupric chloride-talc dust containing only 10 per cent. cupric chloride (i. e., 9·2 gm. of metallic copper). If the seed-grain is uncontaminated and it is merely necessary to protect against secondary infection, the Tourneur apparatus (in which the seed is agitated in a cloud of the dust) will economize nine-tenths of the dust, and allow the copper content to be reduced to about 1 gm. per quintal.

PETIT (A.). **Action de certains sels halogénés sur la spore d'une Ustilaginée, Tilletia levis.** [Action of certain halogenated salts on the spore of an Ustilaginaceae, *Tilletia levis.*]—*Comptes rendus Soc. de Biol.*, xcix, 38, pp. 2003–2004, 1929.

Very good control of *Tilletia levis* [on wheat] has been given, in the writer's experiments, by the halogenated salts of copper and mercury. Cuprous chloride, used as a dust, has been found superior for this purpose to mercurous chloride and the oxides, sulphates, and acetates of mercury. Cupric chloride-talc dusts, containing only 5 to 10 per cent. copper chloride [see preceding abstract], did not show any reduction of toxicity. The toxicity of different salts of the same metal bears no relation to the proportion of the latter. For instance, oxycyanide of mercury is less effective than mercuric iodide, though the latter contains 50 per cent. less mercury. Wheat seed-grain containing 5 gm. *T. levis* spores per kg. was successfully treated with mercuric iodide at the rate of 1 in 5,000 (1 in 15,000 for grain with 1 gm. of spores per kg.).

CONNERS (I. L.). **Smut experiments.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 91–97, 1928.

As the efficacy of the copper carbonate dust treatment against wheat bunt [*Tilletia tritici* and *T. levis*: cf. *R.A.M.*, vi, p. 219; vii, p. 23] depends largely upon the thoroughness with which the dust is applied, tests [full details of which are given] were made during 1927 at the Dominion Experimental Station, Morden, Manitoba, with three types of duster to analyse the various factors influencing the proper application of the dust.

It was ascertained that 60 revolutions at the speed best suited to the type of duster [a formula for calculating which is given] were sufficient to secure a good coating of dust when the grain was not visibly contaminated, but otherwise 90 revolutions are advised.

The copper carbonate dusting increased the volume of the seed by 7·7 per cent., and a further experiment demonstrated that this increase retarded the flow of seed through the drill, only 1·7 bushels of dusted seed being sown for every 1·97 bushels of undusted seed.

In extensive experiments made in collaboration with the experimental farms in various parts of Canada the effectiveness of six [named] proprietary brands of copper carbonate (2 oz. per bushel) in controlling wheat bunt was compared with the control given by five minutes' immersion in a 1 in 320 formalin solution. Very little bunt (2·4 per cent.) developed even in the untreated plots, and none in the formalin-treated plot, while in the remainder infection, when present, did not exceed 0·1 per cent.

The organic mercury dusts semesan, Du Pont No. 12, Bayer, and segetan trockenbeize reduced bunt from 5·7 per cent. in the control to 0·05 to 0·15 per cent.; formalin and 0·25 semesan dip in the same series completely prevented infection. The plants from seed treated with the organic mercury dusts were the most vigorous, those treated with copper carbonate came next in this respect, and the formalin-treated ones last.

In view of the irregular or unsatisfactory results obtained from seed treatment with numerous [named] disinfectants for the control of covered smut of common oats [*Ustilago levis*], neither copper carbonate nor the other preparations can be recommended for this purpose, though it is thought possible that the continued use of the former may eliminate the disease in some parts of Canada.

LIMBOURN (E. J.). **Flag smut resistance tests, 1928. Merredin Experimental Farm.**—*Journ. Dept. Agric. Western Australia*, 2nd Ser., v, 4, pp. 453–457, 1928.

Further tests were made in 1928 at the Merredin Experimental Farm, Western Australia, on the resistance of varieties and pure lines of wheat to flag smut (*Urocystis tritici*) [*R.A.M.*, vi, p. 544]. As before, the Gluyas Early variety, which has proved the most susceptible available, was used as a control. Taking the infection in this variety as 100, the percentage infection in some 40 other varieties tested in 1928 is given in tabular form. Seven of these proved to be immune, while only two had over 50 per cent. infection. They were all strains that had shown appreciable resistance in previous years. Comparing the results of the three years' experiments [a table of which is included] there are now six varieties (Bunyip, Exquisite, Geeralying, Nabawa, Nolba, and Wandilla) that have shown no infection in each year. Of these, only Nabawa (the most widely grown wheat in Western Australia) and Geeralying (extensively cultivated in the Geraldton districts) are suitable for Western Australian conditions.

Pure line resistance tests with various hybrid wheats have been in progress since 1927. Some details of these are given but the trials are not yet completed.

SIMMONDS (J. H.). **Flag smut of Wheat.**—*Queensland Agric. Journ.*, xxx, 6, pp. 542–548, 2 pl., 2 figs., 1928.

A brief account is given in popular terms of the symptoms and causal organism of flag smut of wheat (*Urocystis tritici*), which was somewhat widely distributed in Queensland during 1928. In most crops infection was slight, but in some fields it reached 20 per cent. The usual control methods and sanitary precautions are recommended and it is advised that the susceptible Canberra variety should not be sown in affected areas.

FELLOWS (H.). **Some chemical and morphological phenomena attending infection of the Wheat plant by Ophiobolus graminis Sacc.**—*Journ. Agric. Res.*, xxxvii, 11, pp. 647–661, 2 pl., 5 figs., 1928.

Ophiobolus graminis penetrates the wheat plant directly through the epidermis of the roots and subcoronal internode and coleoptile. The collar becomes infected through the subcoronal internode, and all the tissue of the attacked organs may be invaded, though the endodermis offers some resistance. Certain cell walls in the vicinity of the parasite become thickened or produce elongated lignified

protuberances, which are given the name 'lignitubers', in front of and around the invading hyphae. The walls of the xylem vessels of the subcoronal internode may become so thickened that plugging occurs. In the coleoptile the thickenings occur mostly in the epidermis, while in the roots they are scattered at random. In other tissues the cell walls are liable to be destroyed and the entire root stele, except the xylem, may be completely disintegrated. Microchemical studies show a variable reduction of cellulose in affected roots. The cellulose lost is replaced by lignin and a small quantity of suberin, especially in the thickened walls and 'lignitubers'.

SIMMONDS (P. M.). **Report of the Dominion Laboratory of Plant Pathology, Saskatoon, Sask., in co-operation with the University of Saskatchewan.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 98–112, 4 figs., 1928.

In addition to work already noticed from other sources, the following may be mentioned. When numerous varieties of oats, barley, and rye were grown in pots containing soil inoculated with *Ophiobolus graminis*, the oats remained apparently unaffected, the barley showed root and stem lesions (but except for the Gatami variety was much less susceptible than wheat), while the rye was less affected than the barley. Greenhouse experiments to ascertain how long the mycelium of *O. graminis* remains viable in the soil showed that infection declined greatly after the first two months following soil inoculation, while after the fourth month no seedling died of take-all within five weeks, though the fungus was present in lesions at the base and in the roots. In some pots the mycelium remained viable for twelve months and produced typical symptoms on some plants before they reached maturity.

In a field experiment on one hundred varieties of wheat, five each of oats and barley, and two of rye it was found that inoculation with *O. graminis* resulted in heavy infection on practically all the wheats, the inoculated rows being 50 per cent. below normal height, while an average of 75 per cent. of the plants died. The common varieties of barley were more than 40 per cent. stunted and some 33 per cent. of the plants died, while the Gatami variety was more than 50 per cent. stunted, with 83 per cent. of the plants killed. The oats and rye were only slightly affected.

A field survey of take-all in Saskatchewan indicated that (1) summer fallowing of infected fields or sowing them to oats for one year greatly reduces the disease in the following wheat crop; (2) *O. graminis* is more widely prevalent in the province than was suspected; (3) in north-eastern Saskatchewan the disease was much more prevalent in 1927 than in the previous year; (4) very little seedling blight was caused by the fungus. A detailed survey of twenty-six fields [the results of which are tabulated and discussed] showed that in the fields which were summer-fallowed or sown to coarse grains no infection was present, as compared with a crop injury estimated at from 10 to 15 per cent. in others which had been sown to wheat annually for three years.

HENRY (A. W.). **Diseases of small grain crops.**—*Alberta Agric. Coll. Bull.* 18, 78 pp., 23 figs., 1928.

Brief popular descriptions are given of the chief diseases [for the most part of fungal or bacterial origin] which occur in Canada on wheat, oats, barley, rye, and flax, and of the damage done by them to the crops. Control measures are indicated in each case, and the last few pages of the paper are devoted to the description of the various seed disinfection treatments now most widely used in practice, and also to general recommendations to ensure successful growing of the crops.

The flax diseases discussed include wilt (*Fusarium lini*), rust (*Melampsora lini* var. *liniperda*), anthracnose (*Colletotrichum linicolum*), pasmo disease (*Phlyctaena linicola*), browning or stem break (*Polyspora lini*), and heat canker.

CALDWELL (R. M.). **Preliminary results from cross inoculation and culture studies upon the fungus Rhynchosporium secalis (Oud.) Davis causing scald of cereals and other grasses.**—Abs. in *Phytopath.*, xix, 1, p. 104, 1929.

Rhynchosporium secalis [*R.A.M.*, viii, p. 302] has been isolated from barley, rye, *Agropyron repens*, *Bromus inermis*, and *Hordeum jubatum* near Madison, Wisconsin, and successfully grown in culture. The last-named plant has not previously been reported as a host of the fungus. Monospore cultures of *R. secalis* from barley differ from those from rye in pigmentation, type of growth, and relative abundance of conidia, these characters being very stable. Infection of barley and rye was secured only when the culture originated from the same host. Similarly, only barley became infected where overwintered diseased barley leaves were used as inoculum. These data are considered to point to the existence of distinct physiological strains of *R. secalis* on barley and rye.

CHRISTENSEN (J. J.), RODENHISER (H. A.), & TU (C.). **Susceptibility of Barley varieties to Fusarial head blight in Minnesota.**—Abs. in *Phytopath.*, xix, 1, p. 80, 1929.

In 1928, when barley scab was unusually prevalent in southern Minnesota, 132 varieties and selections were subjected to an artificial epidemic produced in the ears by several species of *Fusarium*. The percentage of infected heads ranged from a trace to 100. The heads of some of the most susceptible varieties, e. g., Meloy, C.I. 1176; Club Mariout, C.I. 261; and Flynn, C.I. 1311, were completely ruined. The resistant varieties included Improved Manchuria, Minn. 184 (17 per cent.); Svansota, Minn. 440 (7 per cent.); and Peatland, Minn. 452 (4 per cent.). Two new smooth-awned varieties, Glabron, Minn. 445; and Velvet, Minn. 447, showed 49 and 68 per cent. infection, respectively.

LEUKEL (R. W.), DICKSON (J. G.), & JOHNSON (A. G.). **Experiments on stripe disease of Barley and its control.**—Abs. in *Phytopath.*, xix, 1, p. 81, 1929.

Stripe disease of barley (*Helminthosporium gramineum*) was practically eliminated by the disinfection of the seed-grain with

ceresan, tillantin dust, and wa-wa dust, in addition to the previously tested uspulun, germisan, and semesan solutions [*R.A.M.*, vi, p. 475]. Abavit B, tutan, semesan, mercury 'C', and S.F.A. 225 V were usually, but not always, effective.

Relatively dry soil (below 20 per cent. saturation) during the period of emergence seemed to favour stripe development as compared with very wet soil. The disease was most prevalent at or below 15° C., moderately so at 20°, barely noticeable at 24°, and absent at 28°. Changing the soil temperature from 12° to 28°, or vice versa, did not affect the incidence of stripe after the first leaf stage.

SAMPSON (KATHLEEN). **The biology of Oat smuts. I. Viability of the chlamydospores.**—*Ann. of Appl. Biol.*, xv, 4, pp. 586–612, 7 graphs, 1928.

The investigation reported upon in some detail in this paper was started in 1925 for the purpose of determining the viability of the smut spores of oat smuts (*Ustilago avenae* and *U. levis*), in view of the difficulty frequently experienced in varietal resistance tests of obtaining a high percentage of infection even by exceedingly heavy contamination of the seed grain. The author's germination tests (the results of which are expressed in terms of percentage germination) were for the most part made on 2 per cent. cane sugar solution or on an extract made from the pales of oats, and included samples of spores up to seven years old. It was established that the spores of *U. levis* have a greater longevity than those of *U. avenae*; the difference, however, is not as wide as suggested by earlier experiments, in which the spores of *U. avenae* had been collected in the field from immature crops. Since in later work maturity was recognized as an important factor affecting the viability and longevity of the resting spores, a special technique [a description of which is given] was elaborated in the case of *U. avenae* to prevent the premature scattering of the fully exposed spores.

The samples of *U. levis* tested exhibited a short 'after ripening' period; their germinability attained a maximum about two months after collection, and they preserved an unimpaired viability during a period of two to two and a half years, while some samples were still viable at the end of five and a half years. Samples of mature spores of *U. avenae*, collected by covering the oat panicles with pollen-proof bags, showed only a slight loss of viability after nearly two years in storage, but the limits of longevity have not yet been established for this species. In both species, viability was affected by exposing the spores to extremely dry or damp storage conditions, but smaller variations in the humidity produced relatively little effect. The difference in germination between one collection of spores and another of the same species appears to depend chiefly upon the age of the sample and the state of spore maturity at the time of collection.

The paper terminates with a brief discussion of the significance of the results of this investigation in regard to different methods of contamination and infection by the two smuts studied.

PIERSTORFF (A. L.) & SAYRE (J. D.). **Further results of Oat-smut control in Ohio.**—Abs. in *Phytopath.*, xix, 1, pp. 102–103, 1929.

Further experiments in the control of the smuts of oats [*Ustilago avenae* and *U. levis*] in Ohio showed that a 5 per cent. formaldehyde dust [*R.A.M.*, vii, p. 159], applied at the rate of 3 oz. per bushel, is most effective; that the treatment need not be made in a closed container; and that the grain should be left in sacks overnight before sowing.

SIMMONDS (P. M.). **Seedling blight and foot-rots of Oats caused by Fusarium culmorum (W. G. Sm.) Sacc.**—*Canada Dept. of Agric. Bull.* 105, N.S., 43 pp., 2 pl., 11 figs., 4 graphs, 1928.

This is a full account of the author's investigations of the seedling blight and foot-rot of oats caused by *Fusarium culmorum*, some previous reports of which have been noticed from other sources [*R.A.M.*, vii, pp. 313, 571, 574]. In discussing the geographical distribution of the fungus, which is also known to attack various other cereals and grasses, it is stated that in the cereal-growing regions of the central parts of the United States *F. culmorum* appears to be less prevalent than *Gibberella saubinetii*, with a tendency for the former to extend northward and for the latter to spread to the south. In western Canada *F. culmorum* is believed to be one of the principal factors, if not the chief factor, in the causation of this group of diseases. The losses caused by it are difficult to estimate, but the virulence of the fungus, as shown in greenhouse experiments, its common occurrence and remarkable adaptability, tend to indicate that under certain conditions it is of considerable economic importance.

The symptoms caused by the fungus in oats, as seen in inoculation experiments and in the field, may be divided into three groups [cf. ibid., vii, p. 710], namely, (1) a pre-emergence blight, which is an invasion and killing of the young plant after germination, so that the shoot does not appear above ground; (2) a seedling blight which occurs some time after emergence, in which the leaves fall over and turn brown, and the invaded portions, including the coleoptile and mesocotyl, exhibit brown lesions; and (3) invasion of the mesocotyl region and adjacent parts which, under conditions favourable for the fungus, may spread to the whole collar, resulting in the killing of tiller buds and root initials, and in the production of stunted plants with few tillers. In thickly sown fields and under humid conditions, the lesions may extend to some distance up the stems, ultimately killing the plant. The fungus readily sporulates on the affected parts.

Infection experiments showed that the conidia germinate readily when placed on the coleoptile or mesocotyl and form a small appressorium over the point of union of the vertical walls, where penetration occurs. It is believed, however, that in nature several germ-tubes usually unite to form a strand, from the lower side of which a large number of penetrating hyphae enter. After penetration, invasion is very rapid in the cortex of the mesocotyl and coleoptile, but is somewhat arrested at the endodermis. The

cortex of the roots is readily invaded, and there was some evidence of penetration through the root hairs.

In discussing the taxonomy of *F. culmorum*, attention is called to its similarity with the *Fusarium* stage of *Gibberella saubinetii*, the chief and most constant difference between the two being the presence of chlamydospores in the former and their absence in the latter. Wollenweber's description of *F. culmorum* is reproduced *in extenso*. In pure cultures, the fungus grew at temperatures ranging from 4° to 32° C., with an optimum between 24° and 28°, and was found to be extremely resistant to desiccation; in one test, a conidial suspension mixed with sterilized soil and then dried retained its viability after a period of two years. Fourteen strains isolated in various regions from different hosts proved to be highly pathogenic to oats, wheat, and barley. The fungus lives over the winter on cereal stubble and other plant débris, and is also carried over on the seed. The initial infection may come either from the soil or the seed.

Experiments made to establish the relation of environmental conditions to the development of the disease showed that oat seedlings develop a very strong root system at rather low soil temperatures, 12° to 15°, while top growth is best at 24° to 28°. Very little disease developed at temperatures from 8° to 15°, while from 18° to 30° the progress of the disease was more rapid. This was true with soil moistures of 20 and 35 per cent. of the water-holding capacity of the soil, but at 50 per cent. somewhat more disease was evident at the lower temperatures. Deep sowing tended to increase the disease, and a depth of sowing of not more than 3 inches is recommended. Sandy soils, under experimental conditions, showed slightly more disease than the other types tested. There was evidence that fields sown early in the season were less diseased than those sown later.

Under greenhouse conditions, certain seed disinfectants, such as semesan, germisan, uspulun, tillantin, segetan, urania, and Dupont dust No. 12 gave satisfactory results, but for the present they are not recommended for general practice. Of all the varieties of oats tested for resistance, only Joanette, a black oat, gave any indication of resistance.

JOHNSON (A. G.), CASH (LILLIAN), & GARDNER (W. A.). **Preliminary report on a bacterial disease of Corn.**—Abs. in *Phytopath.*, xix, 1, pp. 81–82, 1929.

A stalk rot and leaf blight of maize occurred in Alabama in June, 1928, and was later reported from Arlington, Virginia. The internodal pith of the stalks, just above the point of emergence of the ears, was affected by a soft, dark brown rot, which usually killed the tops before or just after tassel formation and caused marked dwarfing. Leaf blight occurred on the middle and upper leaves. The lesions consisted of irregular stripes, water soaked when young, later dry in the centre, pale tan-coloured with sepia margins. The diseased leaves became much shredded in advanced stages of infection. Bacteria were isolated from the invaded tissues, and some of the cultures proved pathogenic on both leaves

and stalks. Both the causal organism and the symptoms are apparently distinct from those of the stalk rot described by Rosen [as *Pseudomonas dissolvens*: *R.A.M.*, ii, p. 158].

JOHANN (HELEN), HOLBERT (J. R.), & DICKSON (J. G.). **A Pythium seedling blight and root rot of Dent Corn.**—*Journ. Agric. Res.*, xxxvii, pp. 443–464, 5 pl., 4 graphs, 1928.

Injuries to maize produced by *Pythium arrhenomanes* [*R.A.M.*, viii, p. 168] may take the form of a rot of the embryo, preventing germination, or it may involve the seedlings, causing a blight which kills them or a milder root rot which merely reduces the size, vigour, and yield of the plant.

The fungus attacks the mesocotyl of the seedling only in the later stages of severe attacks. Infection takes place at the tip of the rootlet, and produces a soft rot which affects the cortex and later the vascular elements.

On potato-dextrose agar fungal growth takes place at temperatures between 4° and 40° C., the optimum for vegetative growth lying between 30° and 36°. Besides sporangia, the fungus is stated to form also conidia, which resemble the oogonia except that they are not provided with antheridia, and which germinate by germ-tubes.

At soil temperatures of about 16° or lower, together with high soil moistures, infection is so favoured that the germination of the kernels may be inhibited or seedling blight be produced. When the plants were not killed in the seedling stage, the height and dry weight of the tops were reduced, especially at the lower temperatures. Some strains of maize appeared to be more susceptible to attack than others.

Field experiments conducted during three seasons tended to confirm these results.

HANNA (W. F.). **Studies in the physiology and cytology of Ustilago zeae and Sorosporium reilianum.**—Abs. in *Phytopath.*, xix, 1, p. 91, 1929.

The sporidia of *Ustilago zeae* are haploid. Maize plants inoculated with monosporidial cultures never produce galls, but those inoculated with mixtures of certain pairs of monosporidial cultures produce galls bearing mature smut spores. On germination, some spores give rise to two pairs of sporidia of opposite sex, while the sporidia from others may belong to four sexual groups. Segregation may occur at both divisions of the spore nucleus. Sporidial conjugation has not been observed. The germ-tube from a haploid sporidium is able to penetrate the epidermis of a young maize leaf. The diploid mycelium is initiated by a fusion of the germ-tubes from two sporidia of opposite sex.

Sorosporium reilianum is heterothallic. Sporidia of four sexual groups may be produced from a single smut spore. Young maize plants develop sori only when inoculated with a combination of two monosporidial cultures of opposite sex.

EDDINS (A. H.). **Pathogenicity of multisporidial and monosporidial cultures of Ustilago zeae (Beckm.) Ung.**—Abs. in *Phytopath.*, xix, 1, p. 91, 1929.

Five multisporidial cultures of *Ustilago zeae* isolated from one smut gall [see preceding abstract] differed in pathogenicity towards seedlings of inbred lines of maize. Five monosporidial cultures derived by dilution from multisporidial cultures failed to produce smut galls on maize plants. When the inoculum of each of the monosporidial cultures was mixed with each of the other cultures, certain paired combinations produced smut spores in the host tissues, while others did not. The five cultures were found to represent four strains, A, B, C, and D. Smut spores were produced in the host tissue when A was paired with C, and B with C or D, but not when A was paired with B or D, or C with D.

STAKMAN (E. C.), CHRISTENSEN (J. J.), & HANNA (W. F.). **Mutation in Ustilago zeae.**—Abs. in *Phytopath.*, xix, 1, p. 106, 1929.

Mutation is stated to occur with surprising frequency in some monosporidial lines of *Ustilago zeae* [see preceding abstracts], which are apparently haploid clones. During a period of nine months, about 100 different mutants were produced by one line and over 70 by another. The constancy of these mutants shows that they are not purely temporary phenotypes, while cytological and genetical studies indicate that they are not the result of normal segregation. The mutants differ from their parents and from each other in one or more of the following respects: morphology, cultural characters, and (apparently) sex, and therefore in potential pathogenicity. The frequency of mutation can be influenced by certain environmental conditions, and sometimes the differences between the mutants can only be detected on suitable media.

DICKSON (J. G.), HOPPE (P. E.), HOLBERT (J. R.), & JANSSEN (G.). **The influence of environment during maturation upon predisposition to seedling blight in Wheat and Corn strains.**—Abs. in *Phytopath.*, xix, 1, p. 79, 1929.

In their recent studies on the correlation between environmental conditions during maturation and the predisposition to seedling blight [*Gibberella saubinetii*] in wheat and maize [*R.A.M.*, vii, p. 777], the writers found that prolific, resistant strains of spring wheat became susceptible and gave poor yields when the seed was grown for one season in the hot, midsummer climate of central Illinois, whereas seed of the same strains ripened at Madison, Wisconsin, produced resistant and normally yielding plants.

Maize grown at Madison under unfavourable autumn conditions was found to be completely susceptible to seedling blight and developed other undesirable characters unlike those of the original line. Little difference was observed in the endosperm composition of these strains, but there were marked changes in the embryo.

HOPPE (P. E.). **Inheritance of resistance to seedling blight of Corn caused by Gibberella saubinetii.**—Abs. in *Phytopath.*, xix, 1, pp. 79–80, 1929.

Selfed strains of maize have been found to exhibit a wide range of relative resistance to seedling blight (*Gibberella saubinetii*) [see preceding abstract] when inoculated and grown at 16° C. Their consistent behaviour at this temperature indicates a high degree of homozygosity for the genetic factors involved in resistance. F_1 hybrids from a resistant × susceptible cross were as resistant as the resistant parent. Analyses of 27 F_3 families gave evidence of transgressive segregation, families both more susceptible and more resistant than the parent strains being isolated. One practically immune F_3 family maintained its high degree of resistance in the F_4 generation, while results in other families indicated a high degree of heterozygosity in the F_3 population.

JOHANN (HELEN). **Further studies on Penicillium injury to Corn.**—Abs. in *Phytopath.*, xix, 1, p. 105, 1929.

Various strains of Dent maize in Illinois and Wisconsin showed marked reduction in stand and yield following inoculation at planting time with a spore suspension of *Penicillium oxalicum* [*R.A.M.*, vii, p. 506]. This fungus is not sufficiently aggressive to enter vigorous, living cells, and sections through lesions indicate that these are killed or injured by a toxic substance in advance of the parasite. Oxalic acid produces similar lesions when applied to the surface of the seedling. Yellowing and desiccation of the leaves, which are symptoms of the *Penicillium* disease, were also reproduced by placing young seedlings in dilute solutions of oxalic acid. Considerable quantities of this substance were detected in maize seedling decoctions on which *P. oxalicum* had grown for six days at 20° C. The fungus is chiefly intercellular, being found in the most severely injured seedlings in the region of the cotyledonary plate. The hyphae penetrate between the cells of the root tip, through the depleted scutellum, the ruptured coleorhiza, root ruptures, or any kind of injured tissue.

ELLIOTT (CHARLOTTE). **Another bacterial leaf spot of Sorghum.**—Abs. in *Phytopath.*, xix, 1, p. 82, 1929.

The leaves of *Holcus* [*Andropogon*] *sorghum* in Texas, Oklahoma, and Kansas are affected by a bacterial disease characterized by reddish-brown streaks, later expanding into elongated oval spots with tan centres and narrow red margins. The profuse exudate dries up into white or cream-coloured scales. Proof was obtained of the pathogenicity of an apparently undescribed yellow organism isolated from the infected tissues.

MAINS (E. B.). **Relative susceptibility of various varieties of Sorghum to rust, Puccinia purpurea.**—Abs. in *Phytopath.*, xix, 1, p. 104, 1929.

Marked varietal differences in reaction to sorghum rust (*Puccinia purpurea*) were observed in greenhouse and field tests at Lafayette, Indiana, in 1928. All varieties of the Sorgo group proved more or less susceptible, Dwarf and Fielding Sumac and

Red Amber being highly, and Leoti Red, Freed, White African, and Kansas Orange moderately so. Of the grain sorghums, all the five strains of Feterita tested were very susceptible. Among the Kafirs, Red Kafir and Sunrise were very susceptible, Dawn moderately so, and Blackhull and Reed fairly resistant. All five strains of Milo were very resistant. Two strains of broom corn and two of Hegari were moderately susceptible. A line of Dwarf Shantung Kaoliang and one of Shallu showed considerable resistance.

FULTON (H. R.) & BOWMAN (J. J.). **Decay of Citrus fruits in transit.**—Abs. in *Phytopath.*, xix, 1, pp. 89–90, 1929.

The results of many years' experiments in the control of citrus rots caused by *Penicillium digitatum*, *P. italicum*, *Phomopsis citri*, and *Diplodia natalensis* [*R.A.M.*, viii, p. 236] have shown (1) that *Diplodia* stem-end rot may be reduced 50 per cent. or more by early removal of spring wood in which the fungus sporulates; (2) that a similar reduction in the incidence of *Phomopsis* stem-end rot may be effected by one application of Bordeaux mixture to the very young fruit; (3) that both types of stem-end rot can be reduced 90 per cent. or more by prompt removal of the stem 'buttons' after picking; (4) that chemical treatments in packing-houses may greatly reduce stem-end and blue mould rots; (5) that precooling and refrigeration are important protective measures during transit; and (6) that prompt and careful handling at all stages are essential to the successful control of citrus rots.

DE CAMPOS NOVAES (J.). **A cura da gommose das Laranjeiras Pythiacystis citrophthora.** [The cure of Orange gummosis (*Pythiacystis citrophthora*).]—*Bol. Agric. São Paulo*, Sér. xxix a, 11–12, pp. 684–689, 1 pl., 1 fig., 1928.

Brief, popular notes are given on the gummosis of oranges and lemons caused by *Pythiacystis* [*Phytophthora*] *citrophthora* in São Paulo (Brazil) and elsewhere [*R.A.M.*, vii, p. 780], accompanied by a Portuguese diagnosis of the fungus and directions for its control by painting the diseased areas with Bordeaux paste (1 kg. of copper sulphate, 2 kg. of lime, and 1 l. of water).

BARDALES (M. A.). **Algunas enfermedades fungosas de los Cafetales de Guatemala.** [Some fungous diseases of the Coffee plantations of Guatemala.]—*Bol. Agric. y Com. Guatemala*, vii, 9, pp. 433–436; 10, pp. 495–499; 11, pp. 543–546, 1928.

A brief, popular account is given of the symptoms caused in Guatemalan coffee plantations by the koleroga disease [*Corticium koleroga*: *R.A.M.*, viii, p. 258], together with full directions for its control by Bordeaux mixture (4 kg. each of copper and quicklime to 50 galls. of water). Similar notes are also given on the diseases caused by *Omphalia flavida*, *Cercospora coffeicola*, and *Rosellinia aquila* [ibid., vi, p. 567; vii, p. 305 *et passim*].

SHERBAKOFF (C. D.). **Verticillium wilt of Cotton.**—Abs. in *Phytopath.*, xix, 1, p. 94, 1929.

Since his first record of *Verticillium albo-atrum* on cotton (*Plant Disease Reporter, Supplement* 61, p. 283, 1928), the author

has obtained the following additional information. The disease occurs not only in Lake County, Tennessee, but also in other places along both banks of the Mississippi River. The main field symptoms distinguishing the *Verticillium* wilt from that caused by *Fusarium vasinfectum* [*R.A.M.*, viii, p. 101 *et passim*] are complete shedding of the leaves, noticeable shedding of young bolls before the withering of the tips and branches, and an absence of any discoloration of the cambium, while new branches frequently develop at the base of the plant. The discoloration of the fibro-vascular bundles is common to both forms of wilt.

BLOCHWITZ (A.). **Schimmelpilze als Tierparasiten. (Vorläufige Mitteilung.)** [Moulds as animal parasites. (Preliminary note.)]—*Ber. Deutsch. Bot. Gesellsch.*, xlvii, 1, pp. 31–34, 1929.

The writer, impressed by various recent reports of the occurrence of parasitic fungi on man and animals (especially insects) in the tropics, conducted a series of experiments with *Drosophila* to determine the mode of infection under natural conditions. The insects were caught in dishes containing cultures of various species of *Aspergillus*, fragments of squashed pear being used as a bait, and transferred to thermostats at temperatures of 25°, 30°, and 35° C. At 28° to 30° all the insects were dead on the following day, covered with mycelium on the second, and with conidiophores on the third ; at 35° the mycosis progressed somewhat more rapidly, while at 25° a few individuals were attacked by *A. clavatus* only. A few dead insects under a bell-jar were observed to infect an entire swarm, producing an epidemic of mycosis.

The parasitic species of *Aspergillus* included *A. fumigatus*, *A. malignus*, *A. flavus* group (including *A. tamarii*, *A. niveus*, and *A. galeritus* n.sp.), *A. nidulans*, and *A. clavatus* (with *A. giganteus*). Other species of *Aspergillus*, *Penicillium glaucum*, and *Mucor mucedo* gave negative results.

High temperatures alone do not suffice for infection, a high degree of atmospheric humidity being also necessary. Under these conditions the conidia adhering to the insects' hairs germinate, and the hyphae penetrate the soft skin of the joints, destroying the whole interior. It is interesting to note that, while all these parasites, except *A. clavatus*, are thermophiles, not all thermophiles are parasitic on insects, e. g., *A. niger*.

BENOIS (K. A.). Грибные болезни Саранчи. Сводка литературных данных и Отчет. [Fungal diseases of locusts. Summary of literature and Report.]—Pamphlet issued by *Микол. и Фитопатол. Лабор. имени проф. А. А. Ячевского* [*Mycol. and Phytopath. Lab. A. A. Jaczewsky*], Leningrad, 49 pp., 18 figs., 1928.

In a brief preface Jaczewski states that this monograph of the entomogenous fungi so far recorded on various species of Acrididae, and more particularly on locusts, was compiled in view of the great dearth of information in Russia on this subject, and of the ever-increasing attention which is being paid there to the possibility of biological control of these pests, since all the measures hitherto taken to minimize their depredations involve considerable

expenditure of money and labour while giving very limited and localized results.

In all, descriptions and brief Russian diagnoses are given of 30 species of parasitic fungi, arranged in systematic order, eight of which are known to occur in European and Asiatic Russia. The synonymy and geographical distribution of the fungi are indicated, as well as the hosts attacked by them. The following species may be mentioned. *Empusa grylli*; *Entomophthora colorata* Sor., which the author believes to be synonymous with the former; *Polyrhizium leptophyae* Giard; *Cordyceps locustiphila* P. Henn.; *C. amazonica* P. Henn.; *C. uleana*, P. Henn.; *Hirsutella floccosa* (Speare) Petch, from Ceylon, which is stated to differ from Speare's original diagnosis in the shape and size of its spores; four species of *Isaria*; *Gibellula elegans* P. Henn.; *Fusarium* (*Cladosporium*) *acridiorum* Giard; five species of *Beauveria*; and *Helminthosporium anonymicum* Jacz. (a parasite of locust eggs in North Caucasus). *Acrostalagmus cinnabarinus* is stated to be a common mould on dead locusts, but is apparently a pure saprophyte. Most of the species described are illustrated.

The second part of the paper is a report of the author's survey in 1927 of the North Caucasus regions reported to be heavily infested by the migratory locust (*Pachytilus migratorius*) [*Locusta migratoria*], with a view to determining the presence of any fungal epidemics among the larvae and adult insects. Of the many thousands of egg accumulations visited, only a small proportion was found to have been destroyed while still underground, and the evidence indicated that the destruction was almost exclusively due to insect parasites or inclement weather and soil conditions, the few fungi met with being evidently secondary organisms, mostly pure saprophytes. No mycotic epidemic could be found also among any of the stages of the hatched insects, as in that year the weather remained exceptionally warm and dry.

The paper terminates with a bibliography of 150 titles.

NOLLA (J. A. B.). **Biologic control of the aphids Rhopalosiphum persicae Sulzer and Aphis gossypii Glover.**—Abs. in *Phytopath.*, xix, 1, p. 102, 1929.

Rhopalosiphum [*Myzus*] *persicae* and *Aphis gossypii* on eggplant, pepper [*Capsicum annuum*], and cucumber were effectively controlled in laboratory and field experiments by spraying with spore suspensions of *Acrostalagmus aphidium*. The method is stated to be very economical and readily applicable under favourable conditions of humidity.

Fungi and fungous diseases. The Adolph Gehrmann lectures.—*The Lancet*, ccxvi, 5498, p. 80, 1929.

This is a review of a series of lectures (reprinted from the *Archives of Dermatology*) which were delivered in 1926 and are now published in book form by the American Medical Association (Chicago). In an introduction to the work Prof. A. Castellani states that 20 per cent. of all tropical human diseases are due to fungi, and that affections due to this cause are by no means rare in temperate climates. The first lecture deals with morphology,

physiology, and taxonomy of the fungi; the second with certain diseases caused by fungi, including those of the tonsils and bronchi, and mycotic invasion of the nervous system; while the third is devoted to cutaneous affections of fungous origin. Stress is laid on the numerous valuable data contained in these papers, and on the increasing importance of mycological studies in the medical curriculum.

McKinney (Margaret J.). **Yeast-like organisms of human origin.**—*Journ. Infect. Dis.*, xliv, 1, pp. 47–55, 1929.

Twelve yeast-like organisms of the *Monilia* [*Candida*] type were isolated in the course of the author's routine bacteriological work in a large general hospital. Eleven of these proved more or less virulent to rabbits and guinea-pigs, and it is considered probable, therefore, that they are responsible for the particular conditions under observation. The organisms produced mycelium but no ascospores, and (with one exception) appear to be only distantly related to the Gram-positive, budding yeast of commerce. Animal immunization produced serums high in agglutinins and complement fixation antibodies.

Jaczewski (A. A.). О болезнях масличных растений. [Concerning the diseases of oil seed plants.]—Reprinted from *Маслобойно-Жировое Дело* [*Oil and Fats Producing Industry*], *1928*, 4 (33), pp. 1–11, 1928.

In giving a brief review of the results of previous research, both in Russia and abroad, on the diseases of linseed and flax [much of which has been noticed from time to time in this *Review*], the author points out the complexity of the phytopathological and economic problems presented by them. In estimating the losses accruing from disease, account must be taken of the depletion of the stands in the field due to various seedlings blights (*Fusarium*, *Colletotrichum*, *Polyspora*, and *Botrytis*), anthracnose [*C. lini*], and the like; and also of the deterioration of the quality of the fibre and linseed caused by parasitic fungi, such as lignification and breakage of the fibres, reduction in the weight and oil content of the seed, and finally the intoxicating properties of the oil from linseed attacked by species of *Fusarium* [*R.A.M.*, v, p. 543]. A good illustration of the effect of parasitic fungi on the quality of the fibre was afforded by experiments made in 1927, in which, with a standard of 20 marks for normal fibre, that from flax stems attacked by *Polyspora lini* only received 5 marks (the lowest notation), those attacked by *Melampsora lini* in association with a species of *Fusarium* developing on the rust, 5 to 7 marks, and those affected with the rust alone, 7 to 9 marks. It is believed that much more attention should be paid to the bacteriosis of linseed seedlings caused by *Bacillus cerealium* [ibid., iv, p. 738], since there is ample evidence that this organism, while of no great importance by itself, prepares the way for seedling attacks by much more dangerous parasites, e. g., species of *Fusarium*. The condition known as 'flax sick soil' has now been definitely shown to be due not to the exhaustion of the soil, but either to the accumulation of toxic substances elaborated by the flax plant itself or to the

cumulative development of pathogenic organisms in the soil, such as species of *Thielaviopsis*, *Asterocystis*, *Pythium*, and the like. Crop rotation is of little help in this case, since the organisms are known to live for a very long time in the soil and many of them are polyphagous. The only effective means of control are either soil sterilization with fungicides (among which uspulun and germisan are stated to have given satisfactory results in Germany) or by steaming (which is costly and cannot be recommended for general practice), or the development of resistant varieties of the host plant. Experiments have shown that there exists in Russia ample material for breeding resistant pure lines, and a short list is given of such lines which, in 1927, remained free from all fungal diseases.

The paper terminates with a list of the parasitic fungi known to attack four other oleaginous plants, namely, sunflower (*Helianthus annuus*), hemp (*Cannabis sativa*), castor (*Ricinus communis*), and soy-beans (*Glycine hispida* and *G. maxima*).

DRAYTON (F. L.). **Studies and notes on the diseases of ornamental plants.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 15–31, 7 pl., 1928.

In this paper notes are given on the diseases of ornamental plant bulbs imported into Canada during 1927 as well as on various diseases observed in the field and in storage. Only some of the references can be noticed.

Tulips were affected by blight (*Botrytis tulipae*) [*R.A.M.*, viii, p. 40] and by grey bulb rot (*Rhizoctonia tuliparum*) [ibid., iv, p. 545]. A basal decay and bulb rot of narcissus was due to a species of *Fusarium*; narcissi were also affected by *B. narcissicola* [ibid., vii, p. 378]. *Sclerotium delphinii* caused a decay of Dutch iris 'bulbs'; the fungus is stated not to have been previously recorded from Holland. The only disease found on imported rhizomatous irises was rhizome rot due to *Bacillus carotovorus* [ibid., v, p. 81], but a root rot and die-back associated with *Leptosphaeria heterospora* and a species of *Phoma* was present in Ottawa gardens on many varieties of this group in early summer. A table is given showing the relative susceptibility to leaf spot (*Didymellina iridis*) [ibid., v, p. 81] of 57 named species of iris. The leaf spot stage of hard rot (*Septoria gladioli*) [ibid., vii, p. 327] was present in 27 out of 53 commercial gladiolus plantations in Ontario, infection ranging from a trace to 100 per cent. On several imported corms of the Nanus types of gladiolus affected with dry rot (*Sclerotium* sp.) [ibid., v, p. 430] sclerotia were found on the corm lesions as well as on the underground leaf sheaths and corm scales. The disease was present in 50 out of 53 commercial plantations in Ontario, while in 37 scab (*Bacterium marginatum*) [ibid., vii, pp. 242, 641] was also found. A storage decay of gladiolus corms of the Nanus type caused by a species of *Fusarium* closely allied to *F. oxysporum* var. *gladioli* [ibid., vi, p. 34] was frequently observed, while storage rot was also caused by *Penicillium gladioli* [ibid., viii, p. 311]. Bacterial blight (*Bact. gummisudans*) [ibid., iii, p. 455], not previously reported in Canada, was present in two gladiolus plantations in

Ontario, while a mosaic-like disease similar to that described by Miss Dosdall [ibid., vii, p. 517] was also observed, though there was no warty condition of the corms. Crocus corms were attacked by *Septoria gladioli* and by the same *Sclerotium* as causes dry rot of gladiolus.

OGILVIE (L.). **A transmissible virus disease of the Easter Lily.**—*Ann. of Appl. Biol.*, xv, 4, pp. 540–562, 4 pl., 1928.

This is a full account of the author's study since 1925 of the serious virus disease, locally known as 'yellow flat', of the Bermuda lily (*Lilium longiflorum* var. *eximium*), short reports on which have already been noticed from time to time [*R.A.M.*, vi, pp. 618, 716]. The disease is stated to have been one of the main factors in the considerable reduction that occurred in the commercial cultivation of this plant in Bermuda. Of the several species of insects commonly found on the lily, only *Aphis gossypii* (not *A. lilii* as formerly suggested) was experimentally shown to transmit yellow flat. There was no evidence that infection is carried in the soil.

Spread of the disease occurs mainly early in the season, in sporadic patches in the fields, the average number of plants infected during the growing season from a central bearer being about 15. The symptoms arising from secondary infection are very similar to those that appear in plants grown from infected bulbs. The mature leaves are not visibly affected, but the fresh growth shows the characteristic symptoms; in the case of late-season infection the leaves tend to be twisted from side to side, and the internodes are somewhat longer than is usual in typical cases, this effect being probably due mainly to high temperature. Affected plants begin to die off about flowering time, some two months before healthy plants, and their root system is usually found to be attacked by secondary organisms. The bulbs from diseased plants are considerably reduced in size, and are flat, compact, and with a marked tendency to split; in consecutive years smaller and smaller bulbs are produced. Plants from infected bulbs seldom flower, while in current-season infection the number of flowers is greatly reduced, the flowers are blistered and twisted, and the pedicels are turned stiffly downwards. It is believed that infected plants never recover.

The disease has also been observed on *Lilium formosum* and *L. giganteum*, and appears to occur in Japan, whence the author believes it was introduced into Bermuda about 1893. No connexion has been established between this disease and any of the other virus diseases of plants that occur in Bermuda. The means of control recommended are roguing, with immediate removal of all infected material, spraying with contact insecticides, and clean cultivation.

WEISS (F.). **The basal rot of Narcissus bulbs caused by Fusarium sp.**—Abs. in *Phytopath.*, xix, 1, pp. 99–100, 1929.

Basal rot of stored narcissus bulbs, caused by a species of *Fusarium* of the section *Elegans*, was most destructive in Virginia and Long Island, New York, in 1928. Field studies have shown

that infection of the roots and basal plate may begin in the field. In certain varieties losses up to 50 per cent. may be sustained. The pathogenicity of the fungus, which has been consistently isolated from typical specimens in all the American centres, as well as from Holland, has been repeatedly proved for narcissus, but other flowering bulbs and also onions are apparently not affected. Injuries favour infection but are not essential to its occurrence.

CAYLEY (D[OROTHY] M.). **'Breaking' in Tulips.**—*Ann. of Appl. Biol.*, xv, 4, pp. 529–539, 3 pl., 4 figs., 1928.

This is a more detailed account of the author's researches on the cause of the phenomenon known to growers as 'breaking' in tulips [*R.A.M.*, vii, p. 723; and above, p. 357]. The condition is regarded as a contagious variegation, the relations between host and virus being of a more or less symbiotic nature. Infection is sometimes localized, so that a 'broken' bulb may have 'unbroken' offsets and vice versa. The bulb itself, however, when once affected, does not appear to recover. Injections of the filtered juice from 'broken' plants did not transmit the affection.

DRECHSLER (C.). **Zonate eyespot of grasses caused by Helminthosporium giganteum.**—*Journ. Agric. Res.*, xxxvii, 8, pp. 473–492, 11 pl., 1928.

The zonate spot of various grasses caused by *Helminthosporium giganteum* [*R.A.M.*, iii, p. 67] has been found in the southern and middle parts of the United States, as far north as Maryland and Missouri. Even under favourable conditions the fungus produces relatively few spores, of short viability and apparently not well adapted, by reason of their size and weight, for extensive dispersal. It was not observed to spread in one season more than 20 metres from a centre of infection. The fungus appears to overwinter as a dormant mycelium on old leaves, fresh conidiophores and conidia being produced in the late spring.

Sporulation takes place on the larger portions of killed tissue, produced either by the coalescence of individual eye spot lesions or by a secondary development of mycelium. The latter occurs only when the leaf surface is covered with moisture; in such cases a prostrate superficial mycelium extends from the margin of the affected tissue and induces a water-soaked condition around the original spot, followed by desiccation and death. The newly infected parts being delimited by marginal bands of colour, the repetition of this type of development brings about the characteristically zonate appearance.

A list is given of a number of grasses, including *Agropyron elongatum*, *A. repens*, *Bromus inermis*, *Cynodon dactylon*, *Eleusine indica*, and others, on which natural infection and sporulation was observed and on which the fungus appeared to be able to propagate itself; several grasses are also listed on which infections were observed when these hosts were in proximity to others more congenial to the fungus.

On artificial media *H. giganteum* develops rather slowly; meagre and somewhat abnormal sporulation generally takes place, the conidia as well as the hyphae often giving rise to branching

systems of small, disarticulating elements, the whole closely resembling the fructifications usually referred to the form genus *Hormodendrum*. Germination takes place by the production of two whorls of germ-tubes, one near each end of the conidium.

McLarty (H. R.). **Report of the Dominion Field Laboratory of Plant Pathology, Summerland, B.C.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 157–189, 19 figs., 1928.

An experiment [brief details of which are given] conducted to determine whether fireblight of apples (*Bacillus amylovorus*) could be carried on the fruit boxes indicated that this organism did not survive on the dry wood, but was able to live on slightly moistened wood for one month.

An account is given of various measures which are being tested for the control of apple collar rot; this prevails throughout the whole fruit-growing area of British Columbia, and in some orchards was present on 80 per cent. of the trees.

Pine tar, rape seed oil, and castor oil applied as dressings to lesions caused on apple trees by perennial canker [*Gloeosporium perennans*: see above, p. 357] were all highly efficacious in repelling the attacks of the woolly aphis [*Eriosoma lanigerum*]. Effective control of this insect will, it is hoped, secure the healing of the cankers on the trunk and main branches.

Full details are given of the author's investigations of the physiological disturbances of apple trees known as die-back, drought spot, and corky core, which have been already noticed from another source [ibid., viii, p. 47].

Harrison (T. H.). **Brown rot of fruits, and associated diseases, in Australia. Part I. History of the disease and determination of the causal organism.**—*Journ. & Proc. Roy. Soc. New South Wales*, lxii, pp. 99–151, 5 pl., 1 map, 1928.

After tracing the history of brown rot of deciduous fruits in Australia, where the disease is now well established in the southeast, the author gives detailed notes on the host range of the fungus and reviews the nomenclature of the brown rot organisms [*R.A.M.*, viii, p. 253] in various countries. In Australia the author has isolated the causal organism from apple, pear, peach, nectarine, apricot, plum, cherry, quince, and blackberry, notes on the damage caused to each of these fruits being given.

A full account is given of experiments in which numerous fruits were inoculated with standard cultures of *Sclerotinia fructigena* and *S. cinerea* obtained from England, and with the Australian fungus, and the resulting symptoms [which are described] carefully compared. The characteristic features produced by the local fungus in culture were as follows: mycelial growth was sparse, but conidial production abundant; the tufts were at first grey, but as the conidia matured the colour changed first to light, then to bright, fawn (between Ridgway's Tilleul-buff and vinaceous buff); the pinhead pustules were often confluent, and were commonly arranged concentrically. Nigrescence of the medium varied in intensity, but always appeared quickly. These characters

differed from those produced by the other organisms. Further detailed tests indicated that the Australian fungus was identical with the American form, *S. fructicola* (Wint.) Rehm [*S. americana* Norton & Ezekiel], with cultures of which it was compared, comparative tests being also made of the pathogenicity of both sets of cultures.

Apothecia of the Australian organism were obtained in abundance; the asci averaged 155 by 10 μ, the ascospores 12·8 by 6·9 μ, and the paraphyses 159 by 2·5 μ. The conidia measured 14·3 to 15·9 by 9·7 to 10·2 μ.

Thousands of natural infections of fruit and twigs were studied in the field, but (up to July, 1928) *S. fructigena* and *S. cinerea* have not been found.

The apothecia of *S. fructicola* have been observed arising from mummified apple fruits, on which they do not appear to have been reported in America.

Evidence was also obtained which indicated that *S. fructicola* is also responsible for the disease in New Zealand.

A bibliography of 52 titles is appended.

LÜTJE. **Massenerkrankungen unter Weidetieren in Obsthöfen nach der Verwendung von Kupferkalkbrühe zur Obstschädlingsbekämpfung.** [Widespread poisoning among grazing stock in orchards following the use of Bordeaux mixture for the control of fruit pests.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst,* ix, 1, pp. 1–3, 1929.

Details are given concerning a number of cases (26 in 1927 and 281 in 1928) of chronic copper poisoning among sheep and other stock in the Stade district [near Hamburg]. There were at least another 600 cases of poisoning among sheep in the Jork district alone (15 to 20 per cent. of the total number maintained). The affected animals were pastured in orchards where the grass was contaminated by copper washed off the trees, which had been sprayed with copper sulphate and other cupric preparations against fruit pests and diseases.

ROSEN (H. R.) & GROVES (A. B.). **Studies on fire blight: host range.**—*Journ. Agric. Res.,* xxxvii, 8, pp. 493-505, 5 figs., 1928.

In artificial infection experiments [details of which are given], inoculations of the blossoms and twigs of Japanese flowering quince (*Cydonia japonica*) with a pure culture of *Bacillus amylovorus* isolated from an apple twig gave positive results, the blossoms being readily infected through the nectaries. No natural infections have so far been reported on this host, but these may easily have been overlooked, as they very closely resemble frost injury.

The blossoms and young twigs of roses (Fairfax variety) were also very susceptible to artificial infection with *B. amylovorus,* as were the young twigs of *Spiraea vanhouttei,* the symptoms on the last-named also resembling frost injury.

B. amylovorus was isolated from naturally infected twigs and

leaf clusters of a Burbank plum (*Prunus salicina*) and found to be infectious on pear shoots.

A list of all the known host plants of *B. amylovorus* is given, and there is a bibliography of 27 titles.

THOMAS (H. E.) & MILLS (W. D.). **Rust diseases of the Apple.**—Abs. in *Phytopath.*, xix, 1, p. 87, 1929.

Apples in the east of New York State are liable to severe infection by three rusts, viz., *Gymnosporangium juniperi-virginianae*, *G. globosum*, and *G. germinale*. The first-named was unusually abundant on both foliage and fruit in 1927 and 1928. *G. globosum* occurs on the foliage of at least 13 apple varieties and *G. germinale* on the fruit of five.

KEITT (G. W.) & WILSON (E. E.) **Third progress report of studies of fall applications of fungicides in relation to Apple scab control.**—Abs. in *Phytopath.*, xix, 1, pp. 87–88, 1929.

Continuing their investigations on the control of apple scab (*Venturia inaequalis*) by the application of various fungicides after harvest and before leaf fall [*R.A.M.*, v, p. 299], the writers found that calcium arsenite (probably chiefly the orthosalt) gave promising results. In several tests this preparation, used in concentrations of 0·25 to 1 per cent. alone or in combination with other materials, reduced the number of perithecia to less than one-tenth of that developing in the controls. Some of the calcium arsenite preparations caused serious injury to the host, and owing to its high toxicity this material cannot yet be recommended for use on a commercial scale.

HURT (R. H.). **Calcium monosulphide, a substitute for lime-sulphur for summer spraying.**—Abs. in *Phytopath.*, xix, 1, p. 106, 1929.

During the past three years calcium monosulphide has been found to be equally effective with lime-sulphur in the control of fungous diseases on Winesap apples, while it is also safer and easier of application. In 1926 and 1927 calcium monosulphide U.S.P., containing approximately 60 per cent. calcium monosulphide, was used at the rate of 12½ lb. to 50 galls. of water. In the 1928 tests, a commercial preparation containing about 65 per cent. calcium monosulphide was used at the rate of 10 lb. to 50 galls. When calcium monosulphide was used as a complete summer spray the average scab [*Venturia inaequalis*] infection was 3·19 per cent., the corresponding figures for lime-sulphur followed by Bordeaux mixture and for the untreated controls being 7·40 and 75·33 per cent., respectively.

PUTTERILL (V. A.). **A comparative investigation into the storage behaviour and keeping qualities of Williams' Bon Chrétien Pears from different localities in South Africa.**—*S. Africa Dept. of Agric. Sci. Bull.* 70, 120 pp., 11 figs., 1 map, 8 graphs, 1928.

An exhaustive account is given of investigations conducted from 1924 to 1926 to compare the storage behaviour of pears of the

Williams variety from 13 widely different localities in South Africa. The chief conclusions in regard to storage disorders may be very briefly summarized as follows.

Scald and internal breakdown [cf. *R.A.M.*, iii, p. 726; iv, p. 746; v, p. 108; vi, p. 144] were the chief troubles, visible scald being noted after about four weeks' storage at 45° F. or nine to ten weeks' storage at 34°. Considerable differences in susceptibility to the condition were noted between the pears from the different districts, but the later pickings were always affected first. Various degrees of control, but on the whole, no very marked benefit, resulted from the use of waxed tissue wrappers. No correlation was established between susceptibility to scald and the chemical composition of the fruit, in so far as this was determined.

A bibliography of 26 titles is appended.

HUTCHINS (L. M.). **Phony disease of the Peach.**—Abs. in *Phytopath.*, xix, 1, p. 107, 1929.

Phony disease of the peach, which was first recorded in Georgia about 50 years ago [*R.A.M.*, v, p. 280], has now spread over the districts producing some 90 per cent. of the commercial crop, and recently appeared also in eastern Alabama. It is a transmissible disease, the infective principle apparently residing only in the roots, and the incubation period being about 18 months. Phony trees produce short terminal growth, profuse lateral branching, and deep green foliage. They never recover, but may live on for a number of years. Economic losses are due to a marked stunting and decrease in the average size and number of fruits per tree. Extensive investigations on the control of the disease by selection are in progress at Fort Valley, Georgia.

RIVES [L.]. **Sur les causes du dépérissement de l'Abricotier par apoplexie.** [On the causes of the dying-off of the Apricot from apoplexy.]—*Comptes rendus Acad. d'Agric. de France*, xv, 2, pp. 77–83, 1929.

In this paper [to which a foreword is contributed by Rabaté], the author briefly summarizes the views of previous investigators on the apoplexy disease of apricots in the Rhone Valley [*R.A.M.*, viii, p. 180] and describes his own recent studies on its aetiology.

Early in August, 1928, a large number of affected trees were inspected at Saint-Vallier (Drôme). The longitudinal brown stripes in the cortex were strongly reminiscent of bacterial infection, and a subsequent microscopic examination of material from the diseased trees confirmed this supposition. Two types of bacteria were found in great abundance in the apparently healthy tissues bordering the discoloured region, viz., (1) a small bacillus staining very faintly with gentian violet and measuring 1·5 by 0·6 to 0·7 μ; and (2) a coccus staining vividly with gentian violet and not exceeding 0·5 μ in diameter. Both organisms produced moriform, somewhat granular, mother-of-pearl coloured to yellowish colonies on agar. Inoculation experiments with these cultures on two- to three-year-old apricot branches gave positive results, both the bacillus and the coccus being reisolated from the discoloured

wood vessels, which contained tyloses and gum. Healthy one-year-old branches generally proved resistant to inoculation.

It is considered probable, as a result of these experiments, that the apoplexy disease of apricots is of bacterial origin. This view is further supported by the absence of the condition in the dry soils and climate of Vaucluse and Bouches-du-Rhône, humidity playing an important part in the development of bacterial diseases. The possibility of the apricot bacteria being identical with the fireblight organism (*Bacillus amylovorus*) was rejected, after due consideration, on account of certain important differences. *B. amylovorus* invades the twigs from the tips and progresses towards the base, while the symptoms observed on apricot branches follow the reverse direction. In fireblight the younger and more vigorous branches are most susceptible, whereas in the apricot disease the older branches are the first to succumb. In the Rhone Valley the plum trees which are extensively used as stocks for apricots are highly resistant to apoplexy, whereas in America they are known to contract fireblight under favourable conditions.

The apricot bacteria are believed to be disseminated by boring insects and, possibly, by pruning implements.

[This communication is reproduced in *Prog. Agric. et Vitic.*, xci, 17, pp. 408–411, 1929.]

SMALL (T.). **A disease of the Strawberry plant.**—*Journ. Pomol. and Hort. Science*, vii, 3, pp. 212–215, 2 pl., 1928.

In this further report on the strawberry disease caused by *Diplodina lycopersici* [*R.A.M.*, vii, p. 730], some details are given of inoculation experiments which showed that all parts of the plant are susceptible to attack, except the crown and (in some cases) the stolons. There is evidence that direct infection of the aerial organs by spores is very improbable under natural conditions, but that infection from the soil readily takes place, especially under damp conditions. The inference is that deep planting, by bringing the petioles in contact with the soil, causes rapid development of the disease. Infection occurs at temperatures ranging from 3·3° to 23° C., but appears to be most severe about 15°. Under glass, the disease usually breaks out in the spring or late summer.

The fungus grew and formed pycnidia in sterile soil, straw, and stable manure, on which media it retained its viability after having been exposed to open-air conditions from September to March. The control measures recommended are based on these findings, and include soil sterilization, if possible by heat, the avoidance of deep planting, the removal and destruction of diseased tissues, including the straw used in greenhouses, and the selection of young plants from clean stocks.

MARTIN. **Zur Bekämpfung des amerik. Stachelbeermeltaues und der Blattfallkrankheit an Johannis- und Stachelbeeren.** [On the control of the American Gooseberry mildew and leaf fall disease of Currants and Gooseberries.]—*Obst- und Gemüsebau*, lxxv, 1, pp. 16–17, 3 figs., 1929.

The writer has obtained excellent control of American gooseberry mildew [*Sphaerotheca mors-uvae*] in a large plantation of

the White Triumph variety near Mannheim [Rhine] by drastic winter pruning of the lateral shoots (back to one bud), leaving a few vigorous shoots with four to ten buds to preserve the shape of the bush [*R.A.M.*, viii, p. 255]. This practice facilitates the access of light and air to the bushes, which are stated to remain practically free from mildew without the aid of spraying.

As in the Palatinate, the damage caused in the Mannheim district by leaf fall of gooseberries and currants [*Pseudopeziza ribis*] is much more severe than that due to mildew. Satisfactory control of leaf fall has been given by the application of 3 per cent. solbar or 5 per cent. lime-sulphur before the swelling of the buds, and 0·75 per cent. Bordeaux mixture after leafage and again after the harvest.

Ashby (S. F.). **The bacterial wilt of Bananas and Plantains.**—*Agric. Journ. Brit. Guiana*, i, 4, pp. 218–220, 4 pl., 1928.

In giving a brief account of the symptoms of the bacterial wilt of bananas and plantains caused by *Bacterium solanacearum* in Trinidad [*R.A.M.*, vi, p. 496], the author states that in 1927 he examined dead cultures of the bacterium isolated by Altson in British Guiana from the vascular bundles of some varieties of bananas and plantains suffering from a similar wilt [ibid., vi, p. 212], the macroscopical and microscopical characters of which lead him to believe that the bacterial disease in British Guiana is identical with that in Trinidad. Natural infection of the Gros Michel variety of bananas has not been, so far, observed either in Trinidad or British Guiana, but under experimental conditions the variety is susceptible to inoculation in the leaf stalks; further observations are therefore necessary to determine whether this variety is resistant or not under field conditions where other varieties have become diseased. The problem of control of the bacterial wilt is considerably complicated by the fact that the causal organism is a parasite of a large number of important crop plants, and also of some common weeds [ibid., viii, p. 74]. It has been noticed in Sumatra, however, that *Mimosa invisa* escapes attack, and that after infected land had been under a close cover of this plant for a number of years, commercial control of the disease was obtained in tobacco [ibid., vi, p. 759].

Williams (R. C.) & Young (H. C.). **Chemistry of the toxic factor of sulphur.**—Abs. in *Phytopath.*, xix, 1, p. 89, 1929.

Continuing their studies on the chemistry of the toxic factor of sulphur [*R.A.M.*, vii, p. 335], the writers found that ordinary ground roll and flowers of sulphur showed varying degrees of toxicity according to reaction, oxidation, temperature, and moisture. Sulphurs treated with such oxidizing agents as potassium permanganate, manganese dioxide, and arsenious acid were found to be extremely toxic [ibid., viii, p. 323]. The only acids associated with sulphur found to be toxic were the polythionic (tetra and penta) acids. All sulphurs freed from these acids failed to control apple scab (*Venturia inaequalis*). The toxic factor was destroyed by alkalis and strong acids.

WILLIAMS (R. C.) & YOUNG (H. C.). **The toxic property of sulfur. Chemistry in relation to toxic factors.**—*Indus. & Engin. Chem.*, xxi, 4, pp. 359–362, 1929.

This is an expanded account, accompanied by tables, of the authors' investigation on the chemistry of the toxic factor of sulphur, a preliminary notice of which has already appeared [see preceding abstract].

GOODWIN (W.) & MARTIN (H.). **The action of sulphur as a fungicide and as an acaricide. Part I.**—*Ann. of Appl. Biol.*, xv, 4, pp. 623–639, 2 figs, 1928.

After a brief review of the various theories advanced to explain the fungicidal action of sulphur when applied by diffusion from a heated surface, and not to the plant or in direct contact with the fungus, the authors describe in detail experiments from which they draw the following conclusions. The active agent in sulphur is a volatile substance that is gaseous in character, since it is capable of passing a glass-wool filter maintained at the temperature of the heated surface. The fact that this substance was removed by passage through a cooled glass-wool filter and the chemical reactions that it produces show that it is neither sulphur dioxide nor hydrogen sulphide, but is volatile elementary (non-particulate) sulphur. The reactions ascribed to particulate sulphur [*R.A.M.*, vii, p. 655] may apparently be accounted for by the condensation on cooling of the sulphur volatilized from the heated surface.

SCHNEIDERHAN (F. J.). **The influence of the form and proportion of lime and copper sulphate on the suspension of Bordeaux mixture.**—Abs. in *Phytopath.*, xix, 1, p. 88, 1929.

About 1,000 tests of Bordeaux mixture, prepared according to 30 different formulae and from various forms of lime and copper sulphate, were made to determine suspension percentages. The highest ratio between suspended Bordeaux and the total volume of liquid was found when chemical hydrated lime and finely granulated copper sulphate were used in the formula 2–3½–50. A close correlation was found to exist between fineness of lime particles, its chemical composition, and suspension ratios. Chemical hydrated lime containing 72·7 calcium oxide, 98·74 per cent. passing through a 325-mesh sieve and with a volume of 3·04 c.c. per gm., used in combination with finely granulated copper sulphate, resulted in a maximum suspension of 98·8 per cent. after one hour, 97·6 after two, and 95·2 after three [*R.A.M.*, vii, p. 732]. The same materials used in 2–4–50, 3–4–50, 3–5–50, and 1–1–50 Bordeaux gave suspension ratios nearly as high as the 2–3½–50. Excellent control of apple blotch (*Phyllosticta solitaria*) has been given for two years by 'Instant' Bordeaux prepared from powdered materials.

WHETZEL (H. H.), MCCALLAN (S. E. A.), & LOH (T. C.). **Calcium arsenate as a fungicide.**—Abs. in *Phytopath.*, xix, 1, p. 83, 1929.

In 1928 pyrox [*R.A.M.*, v, p. 567] gave complete control of *Alternaria panax* on ginseng [*Panax quinquefolium*], while Bordeaux mixture (4–4–50) and copper-lime dust proved ineffectual.

Laboratory tests showed that the fungicidal agent in pyrox is the arsenate of lime rather than the copper or lead arsenate. A 1 per cent. mixture of calcium arsenate in talc was found to be more toxic to the spores of *A. panax* than 4–4–50 Bordeaux mixture, and may be so also to other *Alternaria* diseases, e. g., early blight of potatoes [*A. solani*].

HOUBEN (J.) & WOLLENWEBER (H. W.). **Hexylresorcin und Phenyläthylresorcin gegen pflanzenpathogene Pilze.** [Hexylresorcin and phenylethylresorcin against phytopathogenic fungi.]—*Biochem. Zeitschr.*, cciv, 4–6, pp. 448–455, 1929.

In a series of experiments [details of which are given] the writers obtained excellent results in the inhibition of growth of various parasitic fungi by the addition to malt extract agar cultures of graduated concentrations of hexylresorcin or phenylethylresorcin.

Penicillium glaucum, *Graphium ulmi* [*R.A.M.*, viii, p. 205], *Verticillium albo-atrum*, *Phomopsis oblonga*, and a 'wild' yeast were killed by a 0·01 per cent. concentration of hexylresorcin, while 0·005 per cent. sufficed in the case of the three last-named. The following concentrations of hexylresorcin proved lethal to seven other fungi tested: *Nectria galligena* 0·0025 to 0·005 per cent., *Fusarium aurantiacum* 0·005 to 0·01, *F. lini* 0.01 to 0·02, *Gloeosporium fructigenum* 0·0025 to 0·005, *Polystictus versicolor* 0·03 to 0·04, *Monilia* [*Sclerotinia*] *fructigena* and *Calonectria graminicola* below 0·0025.

In preliminary tests with phenylethylresorcin, *P. glaucum*, *G. ulmi*, *Phoma armeniaca*, and a wild yeast were killed by concentrations of 0·0328, 0·0246, and 0·0164 per cent.

Further laboratory and field trials of the action of these substances on the causal organisms of various important plant diseases are in progress.

LESZCZENKO (P.). **Studja nad działaniem roztworów soli, ługów i kwasów na zarodniki niektórych grzybków chorobotwórczych.** [Studies of the action of solutions of salts, alkalis, and acids on the spores of some pathogenic fungi.]—*Prace Wydz. Chorób Roślin w Bydgoszczy Państw. Inst. Nauk. Gospod. Wiejsk.* [*Trans. Phytopath. Sect. in Bydgoszcz State Inst. of Agric. Science*], 6, 37 pp., 1928. [English summary.]

Continuing his studies of the effect of culture media on the germination of the spores of parasitic fungi [*R.A.M.*, vi, p. 307], the author made comparative germination tests with spores of *Ustilago maydis* [*U. zeae*], *U. avenae*, *Tilletia tritici*, *Verticillium albo-atrum*, *Fusarium solani*, *Puccinia graminis*, *Plasmopara viticola*, and *Monilia* [*Sclerotinia*] *fructigena* in rain, tap, distilled, and twice distilled water, and in solutions of different acid, neutral, and basic salts either alone or in combinations with each other. The results of the experiments [details of which are given] showed that the germination of the spores was more active and more rapid in rain, tap, or distilled water than in twice distilled water. This effect is attributed to the slightly acid reaction of the rain and distilled water, and to the slightly alkaline reaction of the

tap water, the retardation in twice distilled water being probably due to its neutral reaction. Germination was, however, slightly inhibited in tap and distilled water, as compared to rain water, presumably owing to the presence in the former of traces of salts of heavy metals. In a set of experiments in which spores of *T. tritici* (enclosed in small sacs of blotting paper) were immersed for 12 or 24 hours prior to germination in electrolysed water close to the cathode and to the anode and in the middle between the two, it was found that the germination of the spores that had been immersed at the anode and in the middle was considerably stimulated, while that of the spores near the cathode was greatly delayed. The stimulation at the anode is attributed to the excess in that region of hydroxyl ions, while the inhibiting effect at the cathode (more marked in distilled than in rain or twice distilled water) is explained by the combined action of hydrogen and metallic ions. Twice distilled water which, prior to the germination tests, had been in contact with strips of copper, zinc, or iron, exercised an inhibiting action on the germination of the conidia of *P. viticola*, owing to the presence in it of traces of salts of these metals. The injurious action of solutions of neutral salts on the germination of the spores of *U. zeae* is ascribed to the action of the cations on the walls and cytoplasm of the spores; it was much more evident when the spores had been treated previous to germination with a solution of an acid than with a solution of an alkali, and a maximum of inhibition was attained when spores first treated with a solution of an alkali were germinated in a combined solution of an acid and an alkali. Soil extract solutions act injuriously on the germination of spores of *U. zeae* because of the presence of mineral salts in them; acid solutions are more injurious than neutral or alkaline ones, owing to a stimulation of the action of the cations of the salts by the hydrogen ions. No injurious action on germination was found to be exerted by the aluminium ion in soil solutions.

WEISS (F.). **A summary of the important contributions to Potato pathology which have appeared in foreign periodical literature in the past year.**—*Proc. Fourteenth Ann. Meeting Potato Assoc. of America, December 28–30, 1927*, pp. 215–225, [1928. Received March, 1929.]

The principal papers on the virus, fungous, bacterial, and non-parasitic potato diseases appearing in countries outside America during 1926–7 are concisely summarized. All the literature referred to has been noticed in this *Review*.

KOTILA (J. E.). **A review of contributions to Potato pathology which appeared in American publications during the year 1927.**—*Proc. Fourteenth Ann. Meeting Potato Assoc. of America, December 28–30, 1927*, pp. 226–232, [1928. Received March, 1929.]

The principal American papers published during 1927 on the virus, fungous, and bacterial diseases of potatoes are briefly summarized. Most of the work discussed has been noticed in this *Review*.

KOTILA (J. E.). **Transmission studies of virus diseases of Potatoes in Michigan, 1926–27.**—*Proc. Fourteenth Ann. Meeting Potato Assoc. of America, December 28–30, 1927*, pp. 95–101, 2 figs., [1928. Received March, 1929.]

The transmission of certain virus diseases in the Green Mountain and Russet Rural potato varieties was found to be more readily effected by cutting knives than by grafting [*R.A.M.*, v, p. 433]. Spindle tuber and mild mosaic were definitely transmitted by the former method, and there was some indication that leaf roll could also be conveyed from diseased to healthy plants in this manner. Giant hill and hereditary spindling sprout were not transmitted by this method. The successful transmission of infection by the cutting knife appeared to depend on the prevention of the drying of the cut tuber.

SMITH (J. H.). **The transmission of Potato mosaic to Tomato.**—*Ann. of Appl. Biol.*, xv, 4, pp. 517–528, 3 pl., 1928.

The experiments briefly outlined in this paper showed that, while inoculation of tomato leaves with filtered juice from the healthy leaves of nine varieties of potato (the freedom of which from virus diseases had been proved in preliminary experiments) failed to produce any pathological symptoms, inoculation with juice from potato leaves affected with mild mosaic produced a characteristic disease in tomato. This disease may assume two distinct forms, which, however, may also occur concurrently. As a rule, the first symptom is the sudden appearance, within fourteen days, of small necrotic spots either on the inoculated leaf or on the leaf immediately above it; this condition, which may continue for many days, is usually followed by some mottling. The second form is a mottling which also first appears on leaflets near the inoculated one or on the leaf next above, and spreads upwards in the plant as it grows. In many cases this mottling is the only visible symptom throughout the life of the plant, but in the majority a few necrotic spots develop on all the leaves. There is no necrotic streaking of the stems or petioles at any time, in which feature, as also in the distribution of the symptoms, the disease differs definitely from the common streak or stripe disease of tomatoes.

Mild potato mosaic does not appear to be very virulent on tomato. The infected plants, although somewhat stunted, develop well and produce flowers and fruit. When combined with the yellow or aucuba mosaic of tomato, however, it causes a very severe disease with all the characters of true streak. Even after some years of propagation without return to potato, it regularly produced this severe form when associated with the yellow mosaic, whether the two were inoculated together or either was superimposed on a plant already infected with the other. When brought back from tomato (even after long-continued propagation in this plant) into normal potato, the virus reproduced the original disease in the latter in an intensified form which developed in two or three weeks. From tomato the potato mosaic was readily transmissible to other solanaceous plants. Of the fifteen species tested only eggplant and *Physalis francheti* failed to develop symptoms.

Tests of the potato mosaic virus recovered from tomato leaves showed it to be filterable; it was infective in dilutions varying from 1 in 1,000 to 1 in 10,000, but not when diluted to 1 in 100,000. It is less resistant to heat than the tomato yellow mosaic or the ordinary tobacco mosaic (being inactivated in ten minutes at 80° C. in all cases, and sometimes at 70°), and also to alcohol, a 90 per cent. solution of which inactivated it after one hour's exposure. Formalin, 1 in 500 for two hours, apparently killed it, but 1 in 1,500 did not reduce its infectivity.

There was some evidence to show that there exist several strains, differing in resistance but not appreciably in the symptoms produced, of the virus causing mild mosaic in the potato.

MILWARD (J. G.). **Mosaic control by tuber indexing method applied to the Triumph variety.**—*Proc. Fourteenth Ann. Meeting Potato Assoc. of America, December 28–30, 1927*, pp. 88–91, [1928. Received March, 1929.]

During the winter of 1926–7 mosaic was almost completely eliminated from the Wisconsin seed-potato stocks of the Triumph variety by the tuber-indexing method (not more than ten diseased plants out of 4,000 indexed). The work has been in progress since 1923 [see above, p. 358].

WOOLLIAMS (G. E.). **An experiment to develop disease-free strains of Potato at Summerland, B.C.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 224–225, 1928.

As potato crops grown from certified, imported seed commonly show 100 per cent. mosaic within three years of planting in the Okanagan valley, British Columbia, a test was commenced to ascertain whether this was due to local environment or original contamination; seed potatoes of numerous [named] varieties were imported from various localities and those that showed no disease when tested by the tuber-indexing method [see preceding extract] were planted in a field remote from other potatoes and grown in the laboratory in insect-proof cages. Infection occurred only on two varieties in the field and in two cages to which aphids penetrated. The seed obtained from the healthy tubers will be used in further tests.

SCHULTZ (E. S.) & BONDE (R.). **Apical leafroll of Potato.**—Abs. in *Phytopath.*, xix, 1, pp. 82–83, 1929.

Potato plants affected by apical leaf roll are slightly dwarfed and exhibit a rolling of the upper leaves similar to primary leaf roll, and to the rolling of the apical leaves often associated with *Rhizoctonia* [*Corticium*] *solani*, &c. [*R.A.M.*, vii, p. 461]. Apical leaf roll, however, may be differentiated from the primary form of the disease by its persistence only on the upper leaves in succeeding generations. The comparatively small tubers are often attached to short stolons resembling the rather clustered tuber set of witches' broom plants [ibid., viii, p. 122]. The shoots of apical leaf roll plants, however, are taller, stronger, and fewer in number than those found in the witches' broom disease, and they form

larger and fewer tubers. Four seasons' observations have shown that apical leaf roll is perpetuated through the tubers and is transmissible to healthy potatoes. The Green Mountain, Rose No. 4, Irish Cobbler, and Bliss Triumph varieties are susceptible to this disease.

TUCKER (J.). **Potato inspection and certification service.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 228–238, 3 figs., 1928.

Details are given of the work of the Canadian seed potato inspection and certification service during 1927 (when 31,601 acres were entered for inspection), of the improved standard required, and of the great increase in the acreage inspected, especially in Prince Edward Island, as compared with 1926, the prevalence of diseases, chiefly mosaic and blackleg, [*Bacillus atrosepticus*], causing rejection in the various provinces also being noted. Over a million and a half bushels of certified seed were exported from Canada during the year.

STAPP (C.). **Die Schwarzbeinigkeit und Knollennassfäule der Kartoffel.** [Blackleg and tuber wet rot of the Potato.]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xvi, 4, pp. 643–703, 2 pl., 1 fig., 1928.

Altogether 121 bacterial isolations were made in 1924 from potato plants affected by blackleg and tubers suffering from wet rot, the material being collected from widely separated localities in Germany, as well as from Switzerland, Sweden, and England. One culture, isolated from a rotting tuber of the Karz von Kameke variety, was characterized by copious gas production and marked virulence towards the tubers of twelve different potato varieties. This was apparently a mixture of two distinct but very similar species, a saprophyte and a parasite. In April, 1924, there were only 13 colonies of the parasite to 690 of the saprophyte (under 2 per cent.), but by January, 1928, after repeated subculturing from the mixture, the corresponding numbers were 132 and 760 (17·37 per cent.).

A comparative study was made of the 121 above-mentioned isolations and *Bacillus phytophthorus* Appel, *B. melanogenes* Pethy. & Murphy (both from E. F. Smith of Washington and believed to be derived from original cultures), a culture named *B. solanisaprus* supplied by Miss Berridge (London), one named *B. atrosepticus* from the American Type Culture Collection, an unnamed strain of the blackleg organism from Miss Westerdijk (Holland), and two strains of *B. carotovorus* from carrot and iris respectively [cf. *R.A.M.*, ii, p. 85; iii, pp. 137, 164, 166; v, p. 408, *et passim*].

The outcome of inquiries made in Germany indicated a relatively high incidence of blackleg (0·5 to 80 per cent.) in most parts of the country during 1924, 73 different varieties being affected. The corresponding figures for tuber wet rot were 5 to 90 per cent. Field experiments, conducted with artificially inoculated tubers of different varieties from 1923 to 1925, demonstrated the marked dependence of the pathogenicity of blackleg and tuber wet rot on weather conditions. The diseases were much less severe in 1925,

when planting was followed by a protracted dry spell, than in 1924.

Tuber inoculation with even the most minute quantities of pure cultures of the pathogenic strains produced complete decay before the sprouts reached the surface. Some strains proved much more virulent than others and the development of the symptoms was further influenced by the mode of infection. Thus, only a few vigorous plants contracted blackleg during 1924 and 1925 as a result of artificial inoculation of the tubers.

On the basis of serological investigations [which are described in detail] the 128 bacterial isolations examined may be distributed in five groups as follows: (1) 101 German, 1 Swiss, 2 Swedish, and 3 English isolations; the Dutch strain, and those received under the names *B. phytophthorus*, *B. melanogenes*, and *B. atrosepticus*; (2) 13 German isolations; (3) isolation No. 121 from Bornstedt near Potsdam; (4) *B. carotovorus* from carrot and *B. solanisaprus*; and (5) *B. carotovorus* from iris. All the representatives of these five groups agree in the following particulars. They are rod-shaped with peritrichous flagella; Gram-negative, non-acid-fast, secreting volutin; forming on bouillon agar in direct light smooth-edged, humid, glistening, transparent, greenish iridescent colonies; liquefying gelatine; milk is coagulated and litmus decolorized in potato extract; on sterilized potato slices the colonies are cream-coloured and glistening but not damp, while on carrot they are whitish, damp, and transparent. On endoagar the streaks assume a deep red tinge and on eosin-methylene blue agar a blue to bluish-purple coloration. The strains comprised in groups (1) to (3) grew in potato extract acidified to P_H 5·05 but no development occurred at P_H 4·70. In a peptone-litmus agar medium the organisms fermented glycerine and inosite with acid formation; mannite, arabinose, xylose, fructose, rhamnose, and raffinose with acid and gas formation; hesperonal-calcium with gas formation; and amygdalin, arbutin, coniferin, and salicin with acid formation. Nitrates were reduced, but there was no production of indol or phenol.

The strains included in groups (3) to (5) may be distinguished from those of the two first by various characters which have hitherto remained constant. Thus, the thermal death points for (1) and (2) lie between 47° and 48° C., for (3) between 49° and 50°, and for (4) and (5) between 48° and 49°; the maximum temperature for growth is between 36° and 38° for (1) and (2), between 40·8° and 42° for (3), and between 39° and 40·8° for (4) and (5). Generally speaking, gas formation is more copious in groups (3) to (5) than in (1) and (2). The members of group (4), in contrast to those of the other groups, especially (1) and (2), do not attack potato tubers at temperatures of $-1°$ to 1°. None of these differences is considered to justify the separation of the groups into distinct species.

It was impossible to decide the exact systematic position of *B. atrosepticus* van Hall and *B. solanisaprus* Harrison, since no original cultures of these organisms appear to be available. It is proposed that all five groups should be united under the name of the *B. phytophthorus* group, in the same sense as one speaks of the

B. coli group, the names *B. carotovorus* and *B. atrosepticus* not being accepted by the author for reasons that are not based on the ordinary rules of priority.

In addition to potato, the blackleg and wet rot organisms and *B. carotovorus* from carrot proved pathogenic to tomato, tobacco, carrot, horse beans (*Vicia faba*), and onions, but not to *Pelargonium zonale* or *Chenopodium album*. Cultures kept on potato agar and in sterile soil at 25° retained their viability and pathogenicity throughout the winter, as also did the organisms hibernating within the tubers or foliage in the soil.

BURR (S.). **Sprain or internal rust spot of Potato.**—*Ann. of Appl. Biol.*, xv, 4, pp. 563–585, 3 pl., 7 figs., 1928.

This is a full account of the author's investigation of the internal rust spot disease of potato prevalent in Yorkshire, a brief report on which by Millard has been noticed from another source [*R.A.M.*, vi, p. 178]. It was found that there are two distinct diseases liable to be confused, namely, (1) sprain or internal rust spot, and (2) a disease hitherto unrecorded, which the author terms 'corky bacteriosis' of the xylem. The latter appears to be by far the less important of the two, since in the cases investigated it was responsible for not more than 2 per cent. of the tissue destruction observed.

In sprain, the lesions inside the tuber appear in the form of rusty brown isolated spots, streaks, or irregular blotches, in which cavities are often present and which frequently coalesce. They may occur either within or outside the vascular ring, sometimes traversing the latter. While the early stage of the disease closely agrees with that described by Horne as sprain and by Paine as internal rust spot (type A) [ibid., iii, p. 420], the later stage is identical with the sprain or internal brown spot as described by Atanasoff [ibid., vi, p. 179]. The histological structure of the lesions varies slightly according to whether they occur in the starch-packed cortical tissue or in the pith, where the cells are less densely filled with starch, but in either case it is characteristic, one of the features being that the spots are more or less completely surrounded by a cork tissue, the inner layers of which are suberized. Isolations from the lesions yielded a short, very motile, non-sporulating, Gram-negative rod, frequently occurring in pairs, and measuring 1·6 by 0·5 μ, which reproduced the typical spots when inoculated into healthy potatoes. As it appears to be new to science, it is named *Bacterium rubefaciens*. There was little evidence that the organism is able to pass through the skin of fully formed tubers, and it is suggested that it may gain entry at a very early stage through the stomata or lenticels of the tuber-bearing stolon. Since the disease usually appears in only a mild form when the crop is lifted, but develops rapidly and continuously in storage, it is further suggested that the bacteria remain quiescent at first in the water-filled intercellular spaces of the tuber, and become active only when the latter ripens. In potatoes affected with this disease a certain necrosis of the xylem vessels may also occur, although this is slight. The soil on which sprain occurs in a virulent form in the locality investigated is a light

sandy loam deficient in organic matter, and one on which *Actinomyces* scab is often severe.

Corky bacteriosis is essentially a disease of the xylem vessels. It is a rusty brown discoloration of the vascular ring appearing in isolated spots or streaks, or forming a complete ring, when it bears a resemblance to ring bacteriosis (*Bact. solanacearum*); it differs from the latter in the absence of any bacterial exudate, in the production of cork tissues surrounding the diseased elements, and in the fact that it does not spread to the tissues on either side of the vascular ring. It is transmitted from the mother tuber to its progeny through the stolons, and is also contracted from infected soil, apparently by infection of the stolon or the stolon end of the tuber. The causative organism (the pathogenicity of which was proved in inoculation experiments) is a thin rod, occasionally occurring in pairs, less motile than *Bact. rubefaciens*, non-sporulating, Gram-negative, and measuring 2·6 by 0·6 μ. It is named *Bact. suberfaciens*.

The cultural characters of the two organisms are given in a comparative table.

DRECHSLER (C.). **A diplanetic species of Phytophthora causing pink rot of Potato tubers.**—Abs. in *Phytopath.*, xix, 1, p. 92, 1929.

A species of *Phytophthora* with prominently papillate zoosporangia averaging 54 by 37 μ in diameter was isolated in 1923 from potato tubers affected by watery decay in Oklahoma, and from tubers showing a mealy pink rot in Kentucky. Tubers inoculated with the fungus developed a pink rot, characterized by purplish discoloration of the eyes and death of the buds; on exposure to air the cut tissues rapidly turned pink and later blackish. Similar pathological effects are produced by various other species of *Phytophthora*, e. g., *P. erythroseptica*, but the fungus under consideration shows energetic diplanetism of the primary zoospores which, after rounding up, yield secondary ones through an evacuation tube 1 to 7 μ long and 3 μ wide, or indirectly, by the terminal production, on a pedicel 5 to 25 μ long and 1·5 μ wide, of a definitely papillate, ovoid, monosporous germ-sporangium delimited by a basal septum.

MACLEOD (D. J.). **Report of the Dominion Laboratory of Plant Pathology, Fredericton, N.B.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 209–218, 1928.

When Green Mountain potato tubers affected with different degrees of black heart [*R.A.M.*, v, p. 626], produced experimentally by subjecting them at 40° C. to various degrees of oxygen deficiency, were planted out, the germination, vigour, and yield of the resulting plant were in each case inversely proportionate to the degree of black heart induced.

A severe epidemic of late blight of potatoes (*Phytophthora infestans*) having occurred in New Brunswick in 1927, an experiment was conducted in which the dead infected tops and the surrounding soil were given heavy applications of standard fungicides to test

the possibility of reducing infection in the tubers. The results showed no tuber infection in the plot dusted with copper-lime 20–80, 1·01 per cent. infection in the formalin treated plot, and 2·39 per cent. infection in that treated with Bordeaux mixture 8–8–40, as compared with 12·62 per cent. infection in the control.

Details are given of further tests of the value of a number of [named] spray and dust mixtures for the control of early [*Alternaria solani*] and late blight of potato. Under the conditions prevailing in 1927 the sprays (of which Burgundy mixture proved to be the most efficacious) gave better control of late blight than did the dusts, while both gave equally good control of early blight. Pota dust [ibid., vi, p. 747 and next abstract] gave by far the least satisfactory results with either disease.

HURST (R. R.). **Report of the Dominion Laboratory of Plant Pathology, Charlottetown, P.E.I.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 198–205, 1 fig., 1 chart, 1928.

In 1927 early blight of potatoes [*Alternaria solani*] first appeared in Prince Edward Island on 26th July, after which it spread rapidly, but though the premature death of the plants materially reduced the yield, the loss through tuber rot was very small.

Early digging gave good control of *Rhizoctonia* [*Corticium solani*] in three localities.

An experiment conducted to test the relative value in the control of late blight [*Phytophthora infestans*] of pota dust (Stewart, Hudson, Stewart Co., Vancouver, B.C.) applied at the rate of 25 lb. per acre, and Bordeaux mixture 4–4–40 (80 galls. per acre), five applications of each, showed that while the dust gave good results the spray was more effective.

Ziekten van Aardappelknollen. [Diseases of Potato tubers.]—*Versl. en Meded. Plantenziektenkundigen Dienst te Wageningen*, 9, 20 pp., 4 pl., 1929.

This is a revised edition of an earlier pamphlet of the same series [cf. *R.A.M.*, vii, p. 459]. The effects of various fungous, bacterial, and physiological diseases of potato tubers are briefly described in popular terms, and a key is appended showing how each disease may be recognized by one or more conspicuous symptoms.

MARTIN (W. H.). **The value of organic mercury compounds in the control of seed and soil borne scab.**—*Proc. Fourteenth Ann. Meeting Potato Assoc. of America, December 28–30, 1927*, pp. 102–108, [1928. Received March, 1929.]

As in the previous years' tests [*R.A.M.*, vii, p. 262], potato scab [*Actinomyces scabies*] was well controlled in New Jersey by semesan bel, Bayer dip dust, and Bayer 181, applied at concentrations of 1 in 10, 1 in 20, 1 in 24, 1 in 30, and 1 in 40. Used at the lower strengths these preparations are about equal in cost to the standard mercuric chloride treatment. Promising results were also obtained by the application of semesan to the soil at the rate of 30, 60, or 90 lb. per acre.

GOSS (R. W.) & WERNER (H. O.). **Seed Potato treatments for scab control.**—*Proc. Fourteenth Ann. Meeting Potato Assoc. of America, December 28–30, 1927,* pp. 109–116, [1928. Received March, 1929.]

Under Nebraska conditions the hot formaldehyde seed treatment (1 in 120 at 123° F. for four minutes, followed by covering for one hour) gave better control of potato scab [*Actinomyces scabies*] than any of the organic mercury disinfectants tested [see preceding abstract]. The efficacy of the mercuric chloride treatment varied in different localities.

ORTON (C. R.) & MILES (G. F.). **Seed Potato treatments in 1927.**—*Proc. Fourteenth Ann. Meeting Potato Assoc. of America, December 28–30, 1927,* pp. 117–120, [1928. Received March, 1929.]

The results of a series of experiments, conducted in the chief potato growing States from Maine to Oregon, and along the eastern coast from New York to Florida, indicated that the best control of potato *Rhizoctonia* [*Corticium solani*] and scab [*Actinomyces scabies*] is given by the standard corrosive sublimate treatment ($1\frac{1}{2}$ hours' immersion) [see preceding abstracts]. Bayer dip dust, however, caused a marked reduction in the incidence of both diseases, and its facility of application recommends it for practical use.

WERNER (H. O.). **Hollow heart of Potatoes; occurrence and test of thiourea seed treatments for prevention.**—*Proc. Fourteenth Ann. Meeting Potato Assoc. of America, December 28–30, 1927,* pp. 71–88, 3 diags., 3 graphs, [1928. Received March, 1929.]

Continuing his studies on the occurrence and control of hollow heart of Russet Rural New Yorker potatoes in Nebraska [*R.A.M.*, vii, p. 264], the writer found that one hour's immersion of the seed-tubers in 1 to 2 per cent. solutions of thiourea gave very satisfactory results [which are described and tabulated]. The number of stems and tubers was increased by the treatment, which also caused a decline in the size of the tubers and in the incidence of the disease. Similar results were obtained by increasing the size of the seed-pieces to 90 gm. [cf. ibid., viii, p. 58].

ZATTLER (F.). **Über eine Kropfkrankheit des Hopfens in Jugo-slawien.** [On a crown gall disease of the Hop in Jugo-Slavia.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz,* vi, 10, pp. 238–245, 3 figs., 1929.

Popular notes are given on a widespread disease of hops in Jugo-Slavia, characterized by the development of one or more tumours, measuring up to 6 by 4 to 5 cm., on the root collar. Some 3 to 10 per cent. of the hops in the districts recently visited by the writer were attacked by this disease, which is believed to be due to *Pseudomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, viii, p. 130]. The soils in the affected regions are mostly very fertile clay or loess and are given liberal applications of stable manure; their average hydrogen-ion concentration was found to be P_H 6·2.

It is suggested that the immersion of the roots in Gleisberg's uspulun-loam solution [ibid., viii, p. 255] might be a suitable control measure. The disinfection of pruning wounds with a mercury- or copper-containing preparation is also considered advisable.

BERKELEY (G. H.). **Ginseng diseases.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 35–36, 1928.

Two-year-old ginseng roots [*Aralia quinquefolia*] growing in Ontario developed rusty or scabby patches, while four-year-old roots in an adjoining garden showed signs of soft rot, with some rusty patches. Various bacteria and fungi were isolated from both lots, as well as species of *Ramularia* and *Macrosporium* from the rusted areas.

As a rusty condition of ginseng in the United States has already been attributed to a *Ramularia*, it is considered possible that the Canadian disease may be due to the same species.

B[ARBER] (C. A.). **The Havana 1927 conference and Cane diseases.** —*Internat. Sugar Journ.*, xxx, 359, pp. 575–582, 1928.

At the Havana conference of sugar-cane technologists, held in 1927, it was stated that in Hawaii wherever Lahaina had failed owing to root disease [*R.A.M.*, vii, p. 474; viii, p. 266], H 109 had given excellent results; when Lahaina was again tried in the same soil some years later, it failed again. Bourne, working in Florida, inoculated cane seedlings grown aseptically with single-spore strains of reputed pathogens and found a species of *Pythium* and a *Fusarium* to be parasitic in the absence of mechanical injury; the former caused a root rot without change of colour, while the latter produced a red, later dark purple, discoloration. The *Pythium* was the more virulent, in that it was able to enter the fibro-vascular cylinder, whereas the *Fusarium* only attacked the cortical layers, apart from the tissue just below the root tip.

Criticizing the theory that mosaic spreads after the alternate hosts have been weeded out, as the insect vectors thereupon migrate to the canes, Brandes stated that abundant infestation with *Aphis maidis* can occur without weeding. Clean cultivation, while unlikely to eliminate mosaic, owing to the great distances over which the aphids can travel, may, however, considerably reduce infection. Recovery from mosaic has been noted in the noble canes [ibid., viii, p. 132]; in 1922 some Badila seedlings in Hawaii which had been affected with mosaic showed healthy leaves in the upper parts, and cuttings from the tip produced healthy plants, the virus having been screened off at a certain height.

According to the best authorities, New Guinea is the home of *Saccharum officinarum* [ibid., viii, p. 133]; the many types or varieties, particularly striped or highly coloured ones, seen in this region testify to the natural occurrence of seedlings in great numbers, some of which might show greater disease resistance than is, in general, possessed by the canes belonging to this species.

As regards the inoculation of sugar-cane with mosaic by *A.*

maidis, slides of serial sections of the leaf and insect at the moment of feeding demonstrated that the secretion which pours from the tip of the bundle of setae while they are advancing through and between the leaf cells is the actual medium by which the virus is introduced into the plant; the phloem was invariably sought by the insect for food. In every instance a dark saliva penetrated to the sieve tubes and companion cells of the phloem. The evidence indicated this part of the fibro-vascular bundle as the path along which the virus was transmitted through the plant.

In Natal, Storey reported that there appear to be two separate strains both in the mosaic disease and streak of the Gramineae, distinguished by differences in regional distribution and in host range, though the symptoms in each case are similar and typical. In the coastal regions the prevalent mosaic disease resembles that found on sugar-cane in other countries. The plants affected are sugar-cane (except Uba), maize (infection is rare and mild on this host), different varieties of sorghum (but probably no Kaffir types), and various wild grasses. The second supposed strain of mosaic has been found only in the Transvaal at altitudes between 3,000 and 5,000 ft. The only known perennial host is *Sorghum arundinaceum* Stapf; but maize and some varieties of sorghum (including Kaffir) show well-marked symptoms. This strain does not appear to affect sugar-cane. What are thought to be strains of the streak virus specialized to separate hosts have also been found in Natal, where the streak diseases of maize and of Uba cane, as normally present in the field, were experimentally transferred to their respective hosts by *Balclutha mbila*, but cross-inoculations only gave a mild type of infection or none at all. This has been shown not to be due to any weakening of the virus itself in regard to its original host.

EARLE (F. S.). **Sugar-cane varieties in Cuba.**—*Planter and Sugar Manufacturer*, lxxxi, 19, pp. 361–362; 20, pp. 383–385; 21, pp. 404–405; 22, pp. 424–425, 439; 23, pp. 443–445, 459–460; 24, pp. 462–464; 25, pp. 482–484, 1928.

The results are given and fully discussed of extensive field and laboratory studies of all the varieties of sugar-cane grown in Cuba, where mosaic is very prevalent and the widely cultivated susceptible Cristalina cane (now determined to be the same as the Light Preanger cane of Java) is in some districts failing owing to soil exhaustion.

The immunity from mosaic of the *Saccharum sinense* group of thin canes [*R.A.M.*, viii, p. 132] makes Uba and some other varieties (especially C.H. 64/21) of importance where the disease is very prevalent.

The heavy tonnage of the north Indian or *S. barberi* hybrid group on poor, dry lands, their high sucrose content and early maturity, are making these canes increasingly popular in Cuba: Co. 281 is of much importance owing to its early maturity, high sugar yield, ability to thrive on poor lands, and tolerance of mosaic; while Co. 213 is even more tolerant of mosaic and very drought-resistant. P.O.J. 36 is one of the best of the other

hybrid canes of this group that are recommended for planting as very tolerant of mosaic and giving heavy yields.

Among the 'noble' canes there appears to be no hope of finding any strains of Cristalina able to compete in sucrose content with B.H. 10 (12) [ibid., viii, p. 61] and S.C. 12/4, where the influence of mosaic can be eliminated, while the same is true of Badila in certain soils. On all the best lands, and when protected from mosaic, B.H. 10 (12) gave higher yields per acre than any other variety tested, though S.C. 12/4 came a close second; the author firmly believes that these are the two best sugar producers in the world.

In regard to the new series of P.O.J. canes with *S. spontaneum* 'blood', P.O.J. 2725, the most widely planted cane of this series in Cuba, is exceedingly vigorous, adapted to a wide range of soil, and so seldom takes mosaic that it may be safely planted even in heavily infected areas. It is recommended for planting wherever Cristalina is failing. P.O.J. 2727 is highly mosaic- and drought-resistant and seems to be suitable for exhausted red lands.

SAYER (W.). **Mosaic and its control in other Cane growing countries.**—*Agric. Journ. of India*, xxiv, 1, pp. 25–31, 1929.

In connexion with the interest aroused by recent publications on the prevalence of sugar-cane mosaic in India [*R.A.M.*, viii, p. 88], the author gives a brief résumé of the damage caused by this disease in other cane-growing countries, together with notes on the means adopted for its control and on the possibilities of its ultimate eradication.

COOK (M. T.). **Tres enfermedades de la Caña de Azucar encontradas recientemente en Puerto Rico.** [Three Sugar-cane diseases recently observed in Porto Rico.]—*Rev. Agric. Puerto Rico*, xxii, 7, pp. 15–16, 39, 1929.

Notes are given on the recent discovery in Porto Rico of three diseases of sugar-cane. Pokkah boeng, associated in Java with *Fusarium moniliforme* [*Gibberella moniliformis*: *R.A.M.*, viii, p. 265], was first observed by C. M. Tucker in January, 1928, on a hybrid resulting from a cross between P.O.J. 2725 and S.C. 12/4, and subsequently on the P.O.J. 2878, 2727, 2725, 234, 1228, and D. 433 (Ceniza) varieties. Brown stripe (*Helminthosporium stenospilum*) [ibid., viii, p. 134] occurs in a severe form on the B.H. 10 (12) and S.C. 12/4 varieties; while red stripe [*Phytomonas rubrilineans*: ibid., viii, p. 265] has been found on P.O.J. 2878 and B.H. 10 (12).

MASON (E. W.). **Annotated account of fungi received at the Imperial Bureau of Mycology.** List II (Fascicle 1), 43 pp., Imp. Bur. of Mycol., Kew, 1928.

This is the first part of the second list now being compiled of the fungi that have been received from various sources at the Imperial Bureau of Mycology, Kew, since its inception in 1921. Notes are given on species belonging to fifteen genera of the Hyphomycetes, with full discussion of their synonymy, and an attempt is made to bring together all records of fungi which

hardly appear specifically distinct, and to determine to which genus they may be most properly referred. In cases in which it was not possible to decide on the correct generic name, a discussion is given of all the facts having a bearing on the question, which have been so far elucidated.

MIX (A. J.). **Further studies on Exoascaceae.**—Abs. in *Phytopath.*, xix, 1, p. 90, 1929.

Exoascus [*Taphrina*] *deformans* and *E.* [*T.*] *mirabilis* have only been successfully isolated from *Prunus angustifolia* when ascospores from ripe asci were shot on to the agar. *T. deformans* forms uninucleate conidia in culture. Nuclear division occurs in the budding conidium and a daughter nucleus passes into the bud. Copulating conidia and long germ-tubes with binucleate cells, as reported by Miss Wieben for *T. epiphylla* and *T. klebahni* [*R.A.M.*, vi, p. 587], have been observed. The so-called resting cells that develop in culture and show paired or fusing nuclei or a large single nucleus are believed to be ascogenous cells. Binucleate hyphae with plate septa and structures believed to be imperfect asci have also been found. Apparently growth in culture must be initiated by the haploid stage, but cells of the diploid generation occur in established cultures. Cultures were also made of *T. mirabilis* var. *tortilis* from *P. angustifolia*, *T. pruni* from *P. domestica*, *T.* sp. from *Alnus incana* and *A. rugosa*, *T. communis* from *P. americana*, and *T. coerulescens* from *Quercus rubra*.

DOIDGE (ETHEL M.) & SYDOW (H.). **The South African species of the Meliolineae.**—*Bothalia*, ii, pp. 424–472, 1928.

The South African Meliolineae are mainly restricted to the indigenous forests, and each species follows the distribution of its host plant. Four genera are here accepted, namely, *Amazonia*, *Meliolina*, *Irene* (including *Appendiculella*), and *Meliola* (including *Irenopsis*) [*R.A.M.*, vii, p. 743]. The authors recognize 72 South African species, of which 14 are named as new, with Latin diagnoses. All the species are fully described in English and the Beeli formulae (modified by Stevens) are given for each. Host indices, arranged by families and genera, together with a fungus index of genera and species, are appended. A bibliography of 26 titles is also added.

BARIBEAU (B.) & RACICOT (H. N.). **Studies on diseases caused by Sclerotinia-producing fungi in Quebec.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 220–222, 1928.

Cultures of species or strains of *Sclerotinia* isolated from potato stem, sunflower (large sclerotia), sunflower (small sclerotia), cabbage, tomato stem, and beans, were grown at temperatures ranging from 0° to 22° C. The cultures grew well but slowly at the lower temperatures. Cultures of the potato strain and of the small sclerotial sunflower strain were grown at 6° and room temperature with six other strains, including a known strain of *S. minor*; the potato strain and *S. minor* both produced small sclerotia at the

lower temperature, while in all the others the sclerotia were the same size at both temperatures.

Sclerotia collected in 1921 and kept at room temperature in the dry air of the laboratory germinated as well in 1928 as in each preceding year.

Van Der Bijl (P. A.). **Aantekeninge oor enige Suid-Afrikaanse swamme.** [Notes on some South African fungi.]—*South African Journ. of Sci.*, xxv, pp. 181–184, 1928.

Notes are given on several fungi occurring in South Africa, of which the following is of phytopathological interest. *Synchytrium dolichi* (Cke) Gäumann [the taxonomy of which is briefly discussed: *R.A.M.*, vi, p. 260] forms circular or irregular, rust-coloured, crateriform galls, 0·5 mm. in diameter, on both leaf surfaces and on the petioles of *Dolichos* sp., *Glycine javanica*, and *Vigna luteola*; the hyaline to yellowish-brown, more or less spherical spores measure 20 to 32 μ. The fungus has also been recorded in India, China, the Philippine Islands, and Central Africa on *D. gibbosum*, *Dunbaria ferruginea*, and *V. sinensis*.

Van Der Bijl (P. A.). **Descriptions of some previously unnamed South African fungi.—IV.**—*South African Journ. of Sci.*, xxv, pp. 185–187, 1928.

Brief notes are given on several hitherto unnamed South African fungi, of which the following is of phytopathological interest. *Fistulina africana* n. sp., which occurs on the trunks of living *Platylophus trifoliatus* at Kynsna, is characterized by a fleshy, stipitate, subreniform to dimidiate pileus, subgelatinous in the upper layer, measuring 3 by 5 cm. and up to 2·5 cm. in thickness; upper surface maroon-coloured, rough with darker, raised pustules; flesh colourless to ashen-grey; stipe short, lateral, up to 1 cm. in diameter, with putty-coloured spots in the tissue; tubes up to 1 mm. long, separate; mouths round, chocolate-coloured; globose to ovoid or ellipsoid, yellowish-brown spores, 5 to 7 by 3 to 4 μ, with a large central gutta. This is stated to be the first record of a *Fistulina* in South Africa.

Small (W.). **Note on the parasitism of Macrophomina phaseoli (Maubl.) Ashby (Rhizoctonia bataticola (Taub.) Butler.)**—*Trop. Agriculture*, v, 12, pp. 315–319, 1928.

In this note, which is in the nature of a rejoinder to Briton-Jones's criticism [*R.A.M.*, vii, p. 715] of his views on the parasitism of *Rhizoctonia bataticola* (*Macrophomina phaseoli*), the author recapitulates his experiments and field observations tending to show that the fungus is a true parasite, capable of attacking the small feeding rootlets of woody plants in the absence of any contributory factors, either external to, or inherent in, the hosts. He admits, however, the probability that, in nature, resistance to the fungus occurs, and that the number of plants eventually killed by it is only a small proportion of those exposed to its attacks. It is further possible that a really healthy and vigorous plant may be able to avoid invasion by *R. bataticola* of its rootlets by active growth, or to resist its entry or even hold it in check after penetration has occurred.

Briton-Jones (H. R.). **Comments on the above note.**—*Trop. Agriculture*, v, 12, pp. 319–320, 1928.

The author discusses the various points made by Small in the note noticed above in favour of the parasitic nature of *Rhizoctonia bataticola*, but still fails to be convinced by them. He admits that the organism is a parasite on the roots of various hosts, but his work leads him to consider that its parasitism is dependent on other, more primary, factors which predispose the plant to infection.

Dufrénoy (J.). **Les mosaïques du Tabac.** [Mosaic diseases of Tobacco.]—Reprinted from *Office Agric. Rég. du Massif Central, Clermont-Ferrand, Bull.* 9, 14 pp., 9 figs., 1928.

An examination of tobacco leaves artificially infected with mosaic (made while the author was visiting the United States as a Fellow of the International Education Board) showed that as the healthy green colour fades, the chlorophyll grains in affected cells dissolve into fatty globules, while the starch disappears. The large vacuole present in the centre of normal leaves gradually breaks up into numerous small vacuoles within the cytoplasm, which assumes a sponge-like appearance.

At some point in the affected cells a mass of very small vacuoles is always present; the immediately surrounding cytoplasm, which is beginning to undergo alteration, is more readily affected by colouring agents than is that in the remainder of the cell. This transformation gradually extends, the whole cytoplasm contracts, and the death of the cell ensues.

Vinson (C. G.) & Petre (A. W.). **Progress in freeing the virus of mosaic disease of Tobacco from accompanying solids.**—Abs. in *Phytopath.*, xix, 1, pp. 107–108, 1929.

The virus of tobacco mosaic may be precipitated from solution by means of an aqueous solution of safranin [*R.A.M.*, vii, p. 277], and may be recovered by removing the safranin from the precipitate. Material which gives an infectious solution when redissolved in water has been salted out of infectious juice with ammonium sulphate and also with magnesium sulphate. Two volumes of acetone or alcohol, added to one volume of juice from diseased plants at about 0° C., throw down a precipitate containing practically all the virus. Some of the phosphate, sulphate, and most of the protein and pigment may be removed from the juice of diseased plants with low concentrations of lead acetate and barium acetate without apparently removing or injuring the virus. Cleared juice from diseased plants, concentrated *in vacuo* to 0·4 of the original volume and brought to about 0°, gives a precipitate containing only about 10 per cent. of the solids of the original juice but apparently all the original virus, when two volumes of acetate at −15° are added. The virus behaved in many respects similarly to a chemical substance.

VALLEAU (W. D.) & JOHNSON (E. M.). **Weed control and the Potato virus problem.**—*Amer. Potato Journ.*, v, 9, pp. 257–259, 1928. [Received March, 1929.]

In the course of their work on the virus diseases of tobacco [*R.A.M.*, viii, p. 270], the writers have observed that infection is always more abundant in or near fields in which potatoes have been grown for several years. In one field, for instance, where Cobblers have been planted from time to time for the past 14 years and carefully rogued, five virus diseases developed profusely on tobacco; three of these, at least, readily infect potatoes, whence they may be transferred to tobacco again. In a field at the Lexington (Kentucky) Experiment Station, used some twenty years ago for a potato variety test, at least nine virus diseases, besides true mosaic, develop every year on tobacco. The field is a mat of horse-nettles (*Solanum carolinense*) and ground cherries (*Physalis* sp.), many of which are infected by virus diseases, presumably persisting since the time of the potato experiment. It has been demonstrated by transmission experiments that the virus diseases of tobacco in this field originate largely from the weeds. The elimination of the latter [by a method which is briefly indicated] is considered essential to the production of healthy seed-potatoes destined for certification.

VALLEAU (W. D.). **Are blackfire and angular leaf spot of Tobacco identical?**—Abs. in *Phytopath.*, xix, 1, p. 93, 1929.

The form of blackfire of dark tobacco that occurs after topping and suckering is not amenable to the sanitary measures applied against true angular leaf spot caused by *Bacterium angulatum*, and recent field and laboratory studies suggest that two distinct diseases may be involved, the former being a physiological disturbance associated with certain nutritional and seasonal conditions [*R.A.M.*, viii, p. 271]. These blackfire spots developed following rapid growth resulting from heavy applications of a nitrogenous fertilizer, whereas they were prevented by a single further application. Field plot results in Kentucky and elsewhere suggest a relation between potash or stable manure applications and control. Isolations from young blackfire spots failed to yield *Bact. angulatum*, which was sometimes found contaminating older ones.

HILL (J. B.). **Migration of Bacterium tabacum through the leaf tissues of Nicotiana tabacum.**—Abs. in *Phytopath.*, xix, 1, p. 97, 1929.

Bacterium tabacum, the causal organism of tobacco wildfire, has been found to penetrate the intercellular spaces of the host tissues in the form of zoogloeae [cf. *R.A.M.*, viii, p. 250]. In the early stages they often almost surround some of the mesophyll cells, but cause no apparent injury to the protoplast. Injured vessels seem to be frequently penetrated by the bacteria. The rate of migration of *Bact. tabacum* is stated to be extremely slow in comparison with that of *Bact. tumefaciens* and *Bacillus amylovorus*. Few zoogloeae were observed in microscopic preparations made of the tissues less than 48 hours after inoculation, whereas many were present at the end of three days.

TISDALE (W. B.). **Progress in the control of black shank of Tobacco through disease resistance.**—Abs. in *Phytopath.*, xix, 1, p. 93, 1929.

From one of the original selections, made in 1922, of Big Cuba tobacco resistant to black shank (*Phytophthora nicotianae*), a highly resistant commercial strain, but of mediocre quality, has been developed. Some F_5 selections of the progeny derived from a cross between this resistant strain and the higher quality Cuban have shown 98 per cent. resistance and a leaf quality superior to Big Cuba. Certain F_3 selections of the progeny resulting from crosses between F_3 individuals of the Big Cuba—Cuban and Big Cuba—Round Tip hybrids were practically immune from black shank and showed a superior leaf quality to any of the types hitherto tested.

DUCOMET (V.). **L'Oïdium du Tabac (Erysiphe cichoracearum) en Turquie.** [Tobacco mildew (*Erysiphe cichoracearum*) in Turkey.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 10, p. 288, 1928.

Smyrna and Macedonian sessile-leaved tobaccos growing in Turkey are stated to be affected by the mildew *Erysiphe cichoracearum*, the perithecia of which were observed in August, shortly after infection had taken place. Both kinds of tobacco are regarded as hybrids of the *havanensis-brasiliensis-purpurea* varieties, in which *havanensis* blood predominates.

The petiolate, Black Sea tobaccos in which *purpurea* blood predominates are also affected, though the disease was not present at Maltepe [Anatolia], where the annual rainfall amounts to 69·5 cm.

WOOLLIAMS (G. E.). **Tobacco diseases at Summerland, B.C.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 226–228, 1 fig., 1928.

A serious defoliation of tobacco plants takes place annually in the Okanagan valley, British Columbia, for which the name 'tobacco leaf-drop' is suggested. The trouble generally appears early in August but may not be present until nearly harvest time. At first only a few isolated plants are affected, but the condition rapidly spreads. The loss of foliage begins at the base and advances up the main stem, the petioles breaking off about one inch from the point of attachment of the leaf. The damage caused ranges from the dropping of one or two of the lowest leaves to complete defoliation.

No causal organism has so far been found to explain this trouble.

KRAYBILL (H. R.), BREWER (P. H.), SAMSON (R. W.), & GARDNER (M. W.). **The separation from mosaic Tomato plants of toxins which produce some of the typical mosaic symptoms.**—Abs. in *Phytopath.*, xix, 1, p. 108, 1929.

In no case did tomato plants inoculated with a combination of the non-infectious tomato juice filtrate from diseased plants, which produced fern-leaf symptoms [*R.A.M.*, vii, p. 282], together with juice from potato tubers, develop streak disease. This appeared, however, when plants were inoculated with the residue

from the tomato filtrate, containing the tomato mosaic principle, together with juice from potato tubers. Numerous inoculations of tomato plants with the filtrate freed from the infectious mosaic principle have produced the fern-leaf symptoms. Repeated attempts to transfer the latter from diseased to healthy plants by inoculation have given negative results. These filtrates have been heated for 2½ hours at 126° C. without any reduction in their activity. Tomato plants showing the fern-leaf symptoms produced by the non-infectious filtrates often outgrow these effects. Inoculations with filtrates prepared from healthy tomato plants failed to produce the fern-leaf symptoms. These data are considered to show that the material in the filtrates causing the fern-leaf symptoms is non-living, of the nature of heat-stable toxins, and probably produced by the mosaic virus.

BREWER (P. H.), KRAYBILL (H. R.), & GARDNER (M. W.). **Purification and certain properties of the Tomato mosaic virus.**—Abs. in *Phytopath.*, xix, 1, p. 108, 1929.

Juice from mosaic tomato plants thoroughly ground in a food chopper is expressed through heavy muslin in a Cossette porcelain press, diluted with an equal volume of distilled water, and passed three times through a supercentrifuge. The liquid is discarded, the dark green, gummy residue scraped from the bowl of the centrifuge, resuspended in distilled water by stirring with a Bouyoucos deflocculator, and again passed through the supercentrifuge. Aluminium gel with a slightly acid reaction is added to the yellowish, cloudy liquid, so that the yellow colour and suspended solids are eliminated. On filtering the mixture a clear, colourless suspension of the virus, apparently as active as the originally expressed juice of the plant, is obtained. The longevity of the virus in this state at ordinary temperatures is less than two months. The virus is inactivated when the suspension is made more alkaline than P_H 7·7 by the addition of Na OH, and regains its activity at about the same point when HCl is added.

HAHMANN. **Versuche über die Bekämpfung des Tomatenkrebses.** [Experiments in the control of Tomato canker.]—*Obst- und Gemüsebau*, lxxv, 1, pp. 18–19, 1929.

In two consecutive seasons the writer obtained good control of tomato canker (*Didymella lycopersici*) at the Hamburg Institute of Applied Botany by 30 minutes' immersion of the seed in 0·3 or 0·25 per cent. uspulun, supplemented in all cases by soil disinfection with uspulun dust (75 gm. per sq.m.) and by spraying the seedlings with 0·3 per cent. uspulun three weeks after planting out [cf. *R.A.M.*, vii, p. 812].

WEBER (G. F.). **A Stemphylium leaf spot of Tomatoes.**—Abs. in *Phytopath.*, xix, 1, p. 92, 1929.

Florida tomatoes have been attacked during the spring and early summer for the last five seasons by a hitherto undescribed leaf disease. Primary infection occurs on the leaves near the soil surface in the seed-bed or in the field. Secondary infection rapidly involves the entire foliage, especially the topmost leaves. The spots

associated with the disease are small (1 to 4 mm. in diameter), round, oval, or irregular, sunken, with greyish centres and dark margins. The causal organism, a species of *Stemphylium*, made little or no growth below 10° C., though it remained viable at 5°; the optimum temperature for growth was 23° to 26° (32° for sporulation) and the maximum below 35°. Positive results were given by inoculations on several tomato varieties, pepper [*Capsicum annuum*], ground cherry [*Physalis*], eggplant, and *Solanum floridanum*. Weekly applications of 4-4-50 Bordeaux mixture gave good control.

FOËX (E.). **Les périthèces du Microsphaera qui causent les maladies dites du blanc du Chêne en France.** [The perithecia of the *Microsphaera* causing the diseases called Oak mildew in France.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 10, p. 291, 1928.

After recapitulating a number of records of the perithecia of *Microsphaera quercina* on oak in the vicinity of the Rhone valley between 1919 and 1927 [cf. *R.A.M.*, viii, p. 273], the author briefly notes that Arnaud and Foëx adopted the name *M. quercina* for the fungus, considering that it should be regarded as a probable introduction of the species known in the New World, while the name *M. alphitoides* [ibid., v, p. 65] was given by Griffon and Maublanc in the belief that the French and American forms of the mildew were distinct.

CHARPENTIER (C.). **Eau de Javel contre le Nectria.** [Eau de Javelle against *Nectria*.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 10, pp. 288–289, 1928.

The perithecia of *Nectria cinnabarina* being found on wounds caused by mechanical injuries on a sycamore [*Acer pseudoplatanus*], the diseased parts were cut away and the exposed surfaces given four applications of 25 per cent. eau de Javelle [hypochlorite of soda] at five-day intervals, after which they were tarred. The tarring was repeated annually, and three years after the first treatment the fungus had not reappeared.

VANINE (S. I.). Некоторые новые данные о сердцевинной гнили Осины. [Some new facts concerning heart rot of the Aspen.] —Reprinted from *Известия Ленинградского Лесного Инст.* [*Leningrad Forestry Inst. News*], xxxvi, 22 pp., 5 figs., 1 graph, 1928. [German summary.]

This is a brief account of the author's investigation of the heart rot of the aspen caused by *Fomes igniarius*, which is stated to be widespread over the whole extent of European Russia, with an incidence of 70 to 90 per cent. in 60- to 70-year-old trees. In giving a description of the histological changes caused by the fungus in the wood, it is pointed out that in the aspen the black lines inside the decayed timber are few and broad, while in rots caused by the same fungus in the majority of other deciduous trees, these lines are numerous and narrow. An examination of young aspen trees from various regions of Russia (made in the attempt to elucidate the mode of infection by the fungus) indicated that *F. igniarius* for

the most part gains entry through wounds in the trunk or roots, and also through dead branches. Infection of basal suckers from infected mother stumps was not established.

From 75 to 93 per cent. of the one- to ten-year-old aspens examined exhibited a red discoloration in the roots and stems; in the younger trees the discoloration was frequently patchy, extending over several short stretches in the roots and trunk, but in older trees it was generally continuous, and was always associated with a definite injury on the surface of the root or trunk. Microscopical examination of the affected tissues seldom revealed the presence in them of thick-walled, brown, hyphae similar to those of *F. igniarius*, while isolations from the tissues were either negative or yielded a mycelium quite distinct from that of *F. igniarius* in pure culture. In the author's opinion this condition of young aspens is identical with that described by Hartig in firs and beeches under the name 'Wundfäule', but the possibility of infection of the young trees with *F. igniarius* is not excluded.

Chemical analysis showed a reduction in cellulose and a slight increase in lignin in the decayed wood, as compared to healthy wood, and also an increase in the carbon content. On the basis of these findings and of the morphological changes caused in the elements of the wood, the rot produced by *F. igniarius* appears to be intermediate between the 'corrosion' and 'destruction' types of wood rot as described by Falck and Haag [*R.A.M.*, vi, p. 453]. A description is also given of the changes in the physical properties of aspen wood brought about by the heart rot.

ALCOCK (Mrs. N. L.) & BRAID (K. W.). **The control of Bracken.** —*Scottish Forestry Journ.*, xlii, 2, pp. 68–73, 1 pl., 1928.

Notes are given on a disease of bracken (*Pteridium aquilinum*) in Scotland, the cause of which has not yet been definitely ascertained. The first symptom noticed was the development of autumnal tints on the fronds in the early summer, accompanied by the occurrence of black blotches on the stems; the fronds were also lop-sided and the lateral branches were often absent. About a week after these observations were made, a fan-shaped diseased area was noticed eastward of the original centre, and it is suggested that the spores of a pycnidial fungus which was found in the leaves and stems of the diseased plants had been blown in that direction by the prevailing winds. The bracken is stated to be dwindling rapidly over wide areas as a result of the disease.

MCCALLUM (A. W.). **Forest pathology.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 39–41, 1928.

A field study made in the Gaspé peninsular, Quebec, showed that the only decays of balsam fir [*Abies balsamea*] present were red heart rot (*Stereum sanguinolentum*), brown butt rot (*Polyporus balsameus*), and feather rot (*Poria subacida*), though these three were not always found in any one region [*R.A.M.*, viii, p. 276].

Fomes pinicola [see next abstract] was found only once on a living balsam fir in Gaspé, and this is thought to be probably the

first Canadian record of it on green timber. The decay extended about four feet up the trunk; the fungus had apparently effected an entrance through a small side root.

MOUNCE (IRENE). **Cultural studies of wood-destroying fungi.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 41–44, 1928.

A series of all possible pairings of monosporous mycelia from one sporophore of *Fomes pinicola* [cf. *R.A.M.*, vii, p. 354] showed that this fungus is heterothallic and bisexual. *Cryptoporus volvatus* from dead *Pseudotsuga taxifolia* in British Columbia was also found to be heterothallic and probably bisexual.

The sporophores of *Collybia velutipes* were found repeatedly on the trunks of crab apple [*Pyrus coronaria*], mountain ash [*P. americana*], and basswood trees [*Tilia americana*] at Ottawa. A section from the trunk of a mountain ash blown down in a storm showed advanced rot typical of *C. velutipes*, and later the sporophores of the fungus developed from the base of the block. Clumps of the fungus were also found on dead and sickly basswood trees, and cultures made from the rotted areas yielded the mycelium of *C. velutipes*, with rudimentary sporophores having typical stipes; this fungus is therefore considered responsible for the condition.

HAHN (G. G.). **The inoculation of Pacific northwestern Ribes with Cronartium ribicola and C. occidentale.**—*Journ. Agric. Res.*, xxxvii, 11, pp. 663–683, 3 graphs, 1928.

After a brief reference to the relative economic importance in North America of the native pinon blister rust (*Cronartium occidentale*) and of the white pine blister rust (*C. ribicola*), both of which are readily distinguishable from one another in their aecidial stage on pines [*R.A.M.*, vi, p. 589; vii, p. 208], the author states that advance infections of both rusts in their uredo stages on species of *Ribes* are widespread and occur co-extensively. This fact, coupled with the difficulty of differentiating between the rusts on these hosts by any morphological criterion so far established, prompted him to undertake the greenhouse infection experiments described in detail in this paper, in the attempt to find a method by which the organisms may be assigned with certainty to their proper species, by the study of their reactions on various species of *Ribes*.

Comparative inoculations were made with *C. ribicola* and *C. occidentale* on 16 species of *Ribes* occurring naturally or cultivated in the Pacific northwestern region. The results did not indicate the existence of any essential physiological difference in the behaviour of the two species under artificial greenhouse conditions, with the exception that *R. triste* was immune from *C. occidentale* and susceptible to *C. ribicola*. As, however, *R. triste* is difficult to propagate in the greenhouse and its susceptibility to *C. ribicola* is only slight, it is of little value as a differential host.

Practically all the species of *Ribes* tested were decidedly susceptible to *C. ribicola*.

FAULL (J. H.). **A fungous disease of Conifers related to the snow cover.**—Abs. in *Phytopath.*, xix, 1, p. 91, 1929.

A destructive disease of conifers, due to a species of *Phacidium* agreeing with *P. infestans*, is reported from the snow-laden regions of north-eastern America, and it may occur in the west. *Abies*, *Picea*, *Thuja*, and *Pinus* are sporadically attacked by *Phacidium* blight in the native forests, the white spruce [*Picea canadensis*] suffering to an alarming extent when the disease gains a foothold in nurseries and plantations. Infection develops and spreads by means of the mycelium under the snow cover in early spring, and primary infection from ascospores probably occurs in the autumn. Perfect control of this disease in nurseries and plantations has been obtained by late autumn spraying with lime-sulphur, combined with suitable sanitary measures.

KONEFF (G. I.) Сердцевинная гниль Сосны в Чумышском лесничестве, Барнаульского округа. (Таксационное обследование). [Heart rot of the Pine in the Tschumyshsky Forest, Barnaul district. (Taxation survey).]—Reprinted from *Труды Сибирского Инст. Сельско-Хоз. и Лесоводства* [*Trans. Siberian Inst. of Agric. and Forestry*], Omsk, xii, 3, 16 pp., 4 figs., 1929.

The results of a preliminary survey made in 1928 showed that in the pine forests [species not indicated] of the Barnaul district [Western Siberia] the incidence of the heart rot caused by *Trametes pini* [*R.A.M.*, vii, p. 812] is very high, and the losses from it very considerable. The nature of the undergrowth in the forests was found to have an influence on the frequency and severity of attack by the fungus, the highest percentage of diseased trees having been recorded in forests with herbaceous cover (*Pinetum herbosum*), and the lowest in forests with bare, sandy soil (*Pinetum stepposum*), while in forests with shrubby undergrowth, the incidence was intermediate. The presence of fruiting bodies of *T. pini* was not a sufficient criterion for the determination of decaying trees, as they are rarely formed in the initial stages of the rot; a more reliable indication is the presence on the trees, even when suffering from incipient rot, of strands of felted, brown, dry hyphae which emerge through the decayed remains of dead twigs. Excessive exudation of resin appeared to hamper, and in some cases to prevent, the formation of the fruiting bodies. In most cases, the heart rotted area was cylindrical in shape, extending for many meters inside the trees, with characteristic, finger-shaped projections at the top and bottom. The volume of decayed wood increased with the age of the tree, and was greater proportionately in the suppressed trees than in the more vigorous dominant ones [cf. ibid., viii, p. 277].

In noting the very neglected condition of the local forests, the author states that a measure of control might be attained by a shorter rotation of felling (at present the forests contain a large number of trees over 200 years old), and a systematic removal of infected material, including windfalls.

DRAVERT (V. P.). Сердцевинная гниль Сосны в Соколовской и Боровлянской лесных дачах, Бийского округа. (Таксационное обследование). [Heart rot of the Pine in the Sokolovaskaya and Borovlianskaya forest estates, Biisk district. (Taxation survey).]—Reprinted from *Труды Сибирского Инст. Сельско-Хоз. и Лесоводства* [*Trans. Siberian Inst. of Agric. and Forestry*], Omsk, xii, 3, 13 pp., 1929.

The survey of the pine forests in the Biisk district [Western Siberia] which was made in 1928 gave results entirely comparable with those obtained by Koneff in the Barnaul district [see above abstract] in respect of the incidence and economic importance of the pine heart rot caused by *Trametes pini*. The only difference of any importance was that in this district trees belonging to the II and III classse of suppression (according to Kraft's classification) were relatively more heavily infected than those of the I, IV and V classes (i. e., than the more dominant or more suppressed).

MEINECKE (E. P.). **A report upon the effect of excessive tourist travel on the California Redwood parks.**—California State Printing Office, Sacramento, 20 pp., 1928.

Attention is directed to the injury that is increasingly being done to the old redwood trees [*Sequoia sempervirens*] in the national parks of California by the compacting of the soil that results from heavy tourist traffic. In trees like the redwood, where the most important feeding roots are very close to the surface of the soil, the rootlets develop and function normally only when the soil is undisturbed, loose, well aërated, and provided with the foodstuffs formed by dead and decaying plants.

Instances are given of the result of this compacting of the soil on individual trees, the roots of which were examined by means of trenches, and in conclusion recommendations are made for minimizing the injury resulting from this cause.

HUNT (G. M.). **Comparative decay resistance of heartwood of different native species when used under conditions which favour decay.**—*U.S. Dept. of Agric., Forest Products Lab. Publ.*, 3 pp., 1928. [Mimeographed.]

General comparisons of the relative resistance to decay shown by different species of trees [cf. *R.A.M.*, viii, p. 78] from service records and general experience in North America indicate that the heartwood of the following species is very durable even under conditions favourable to fungal decay: the catalpas, nearly all cedars, chestnut, southern cypress [*Taxodium distichum*], the junipers, black locust [*Robinia pseud-acacia*], red mulberry [*Morus rubra*], osage orange [*Maclura aurantiaca*], redwood [*Sequoia sempervirens*], black walnut [*Juglans nigra*], and Pacific yew [? *Taxus brevifolia*].

Similarly, the heartwood of aspen [*Populus tremula* and *P. tremuloides*], basswood [*Tilia americana*], cottonwood [*P. deltoides*], the true firs [*Abies* spp.], and the willows shows low resistance under conditions favouring decay, while that of various other species listed is intermediate.

LUDWIG (O.). **Untersuchungen an Ascochyta pisi Lib.** [Investigations on *Ascochyta pisi* Lib.]—*Beitr. Biol. der Pflanzen*, xvi, 3, pp. 464–510, 4 pl., 1 graph, 1928.

A full account is given of the writer's cultural and morphological studies on *Ascochyta pisi* [*R.A.M.*, vii, p. 1]. The material used in the investigations was obtained from a monospore culture isolated from diseased pea leaves at the Göttingen Institute of Agricultural Bacteriology in 1923.

The physiological reactions of the fungus are described at considerable length and compared with those of *Aspergillus niger*. The optimum temperature for spore germination in *Ascochyta pisi* was found to be 25° C., with a maximum at 35° and a minimum below 5°. The fungus grows equally well in light and darkness.

All attempts to induce the formation of perithecia on a large variety of media gave negative results. In nature pycnidia are the only reproductive organs observed, but in culture sporodochia and chlamydospores are formed.

The fungus maintained its viability in culture for over four years and produced typical symptoms of infection on pea plants inoculated by means of a spore emulsion applied to the stems, leaves, and young pods. The germ-tubes were not observed to enter the leaves through the stomata but to penetrate the cuticle, between which and the epidermal wall they first proceed for a short distance until they reach a vertical cell wall; they then penetrate along the latter into the deeper tissues, dissolving the middle lamellae in their course. The incubation period lasts four or five days. Young pods were shed 14 days after inoculation and stem base inoculations caused marked injury to young plants. Infection of the seed from the pod wall was not observed, but when germinated seeds were inoculated, the shoots were stunted or destroyed. It is believed that seed infection requires special conditions or a particular stage of development of the host plant. The results of pot experiments showed that the chief risk of infection by *A. pisi* lies in the use of diseased seed, which leads to infection and subsequent destruction of the delicate stems of the seedlings at the root collar. Subsequent attack on the foliage causes only a negligible amount of damage. There appears to be no likelihood of the conidia overwintering in the soil if the diseased refuse of the pea crop is removed after harvest. The fungus failed to develop to any extent on damp sterilized soil in Petri dishes, and on the local experimental plot there was not a single diseased pea plant in 1924, notwithstanding heavy infection on the same area in the previous season.

Phaseolus, *Vicia faba*, and various other Leguminosae have been mentioned in phytopathological literature as hosts of *A. pisi*. The writer's inoculation experiments with this fungus, however, gave uniformly negative results except on peas, though black spots, which showed no trace of mycelium or spores, formed on *V. faba*.

The cytology of *A. pisi* is discussed in some detail.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

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CLAYTON (E. E.). **Spraying experiments with Bush Lima Beans.** —*New York (Geneva) Agric. Exper. Stat. Bull.* 558, 22 pp., 2 figs., 1928.

A full account is given of extensive spraying tests carried out from 1923 to 1926 on Long Island for the control of bacterial spot (*Bacterium vignae*) and downy mildew (*Phytophthora phaseoli*) of Bush Lima beans [*Phaseolus lunatus*: *R.A.M.*, v, p. 401].

The results [which are tabulated and discussed in detail] showed that the best control was given by Bordeaux mixture (4–6–50, or 6–8–50 in severe downy mildew attacks), while New Jersey dry mix sulphur-lime failed to give effective control, and copper acetate and uspulun caused vine injury; copper-lime dust was rather less effective than Bordeaux mixture.

Pre- and post-blossom sprays gave good control of *Bact. vignae* and increased the yield by as much as 43 per cent., according to the severity of infection; post-blossom applications alone gave no increase in yield. Similar applications against *P. phaseoli* gave increases in yield up to 964 per cent. over the control; in this case, post-blossom sprays alone also gave marked increases in yield.

Two applications should be made at an interval of seven to ten days just before the plants are in bloom, followed by three to six applications at intervals of seven days from the time when the beans begin to set thickly. In dry seasons spraying may be discontinued early, but in wet periods it should be continued to within one week of picking or between pickings if more than one is made. If a dust is preferred, 15–85 or 20–80 copper-lime is recommended.

PLAUT (M.). **Die Rübenkrankheiten des Jahres 1928.** [Beet diseases during the year 1928.]—*Centralbl. für Zuckerind.*, xxxvii, 2, pp. 39–41; 3, pp. 68–70, 11 figs., 1929.

Root rot of beets (*Phoma betae*, *Pythium de Baryanum*, and *Aphanomyces* [*levis*]) was exceptionally severe in various parts of

Germany, e.g., Mecklenburg, East Prussia, Saxony, and Schleswig-Holstein, in 1928. In the writer's seed disinfection experiments [the results of which are tabulated] the disease was well controlled in different types of soil by two hours' immersion in 0·25 per cent. uspulun or germisan, sprinkling with 1 per cent. germisan, or dusting with 1 per cent. tillantin. It is pointed out that seed treatment in Germany [*R.A.M.*, viii, p. 283] often fails to give profitable returns because the fertile plains in which beets are usually cultivated on a commercial scale do not harbour the causal organisms of root rot. In Holland, however, in humus-containing marshy soils, good results are frequently reported [ibid., vi, p. 648].

GROOSHEVOY (S. E.). К вопросу о поражаемости корнеедом марок Сахарной Свеклы. [On the question of the susceptibility to root rot of strains of Sugar Beet.]—*Труды Мироновской Оп.-Селекционной Станции, Секция Фитопатологии.* [*Trans. Mironovka Exper. Seed Selection Stat., Phytopath Sect.*], *1928*, 2, pp. 3–44, 2 graphs, 1928. [English summary.]

The investigation described in some detail in this paper was carried out in the period from 1925 to 1927, inclusive, at the Mironovka [Ukraine] Experimental Seed Selection Station for the purpose of studying the susceptibility or resistance to root rot of strains of sugar beet of various origin [cf. *R.A.M.*, viii, p. 7]. Since the complex nature of the disease (caused by different species of fungi of not yet determined relative importance) rendered infection experiments under controlled conditions, as usually practised in varietal resistance tests, impossible, a large number of strains, originating from various parts of the Ukraine and from abroad, were sown side by side in field plots known to be infected. Preliminary experiments showed that the most reliable data on the incidence of the disease are supplied by examination of the seedlings at the stage of development of the first pair of leaves, since examination of seedlings with three pairs of leaves constantly gave a reduction of over 50 per cent. in the incidence, owing to the recovery of infected plants, while the reduction in the density of stand was only about 14 per cent., representing the plants that had succumbed.

The results of three years' observations lead the author to the following tentative conclusions. The susceptibility of a given strain is apparently influenced by the conditions under which the seed was produced, the environmental conditions of growth of the seedlings, and also by some, as yet undetermined, biological properties of the strains or varieties. Groups of strains originating from a given station or producer, in general, maintained their response to infection throughout the three years, but variations in incidence were noted within these groups, and to a still greater extent in given strains originating from different stations. Selection of root rot resistant strains would, therefore, appear to be possible, but the work must be conducted under strictly similar conditions of growth of the seedlings during the tests, and also with seed produced under identical conditions.

SAILLARD (E.). **La Betterave à sucre et la cercosporiose.** [Sugar Beet and cercosporiosis.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 10, pp. 292–299, 1928.

After noting the symptoms of the leaf spot of beets caused by *Cercospora beticola* [*R.A.M.*, vii, p. 695], and describing in brief detail the effects of the disease in reducing the sugar and increasing the nitrogen content of the roots, the author records the results of observations made during a tour of northern Italy in 1928. *C. beticola* is endemic in Italy, where it is favoured by the alternation of wet with hot, dry periods, and by irrigation. In 1928 it was less prevalent than usual, but contrary to what normally occurs, late sowings were more susceptible than early ones.

In Italy the best control (taking cost into consideration) was given by dusting the leaves with cupric powders during the growth of the crop. One man can treat 2 or 3 hectares per day, at an inclusive cost of 250 to 300 lire per hectare [roughly, 22*s.* to 26*s.* per acre] for several applications, and the fields so treated may yield 5,000 to 6,000 kg. more beets per hectare, and of better quality, than the untreated fields. Disinfection of the seed-clusters has not given effective control in Italy.

WOOLLIAMS (G. E.). **Fusarium bulb-rot of Onions at Summerland, B.C.**—*Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric.*, pp. 189–192, 3 figs., 1928.

A bulb rot of onions, accompanied by wilting and yellowing of the leaves, which all incline to the same side, has recently become increasingly prevalent on rich, low-lying soil in the Okanagan valley, British Columbia, where field losses now average 10, and may reach 60 per cent. The disease appears early in July and gradually spreads until the maximum infection is reached at harvest time.

Needle prick inoculations of field and cured bulbs with a species of *Fusarium* isolated from diseased plants gave positive results.

DUFRÉNOY (J.) & GAVIS (G.). **Etude cytologique de Laitues infectées par le Sclerotinia libertiana.** [A cytological study of Lettuces infected by *Sclerotinia libertiana*.]—*Rev. Path. Vég. et Ent. Agric.*, xv, 10, pp. 300–308, 6 figs., 1928.

When lettuces were inoculated with a strain of *Sclerotinia libertiana* [*S. sclerotiorum*] isolated from melons most of the plants died, but others after showing signs of wilting regained their turgescence and continued to grow.

In the lettuces which succumbed, the hyphae penetrated the cortical parenchyma and caused the cells at some distance in advance of the parasite to become plasmolysed and detached owing to the destruction of the middle lamellae. The hyphae extended between the plasmolysed cells, in which the vacuolar system broke up into small vacuoles containing non-colourable matter and separated by a cytoplasmic network. Many of the mitochondria evolved as amyloplasts which formed starch grains, but some amyloplasts became vesiculated.

In the lettuces that regained turgescence, the mycelium disappeared from the inoculated parts. Sections of the stalk made at the point of inoculation showed a canker-like lesion bordered by several layers of cells, each with a very large vacuole containing yellowish-brown matter rich in phenolic compounds. The hyphae penetrated only the outer cells, and either appeared to be empty or showed fatty degeneration. They did not contain vacuoles colourable by neutral red.

Other cases were observed in which the mycelium penetrated the cortical parenchyma somewhat deeply; some cells near the hyphae showed marked fragmentation of the vacuoles, with slight plasmolysis. Mitochondria and plastids were absent, and after staining with haematoxylin, the cytoplasm appeared as a black contracted mass containing numerous spherical or filamentous lacunae. Other cells near the hyphae remained turgescent, developing a very large vacuole containing phenolic compounds.

S. sclerotiorum being markedly polyphagous the author believes that there is little prospect of obtaining varieties of plants resistant to it. Infection is favoured by unsuitable nutrition and growth conditions of the host.

GLADWIN (F. E.). **Downy and powdery mildews of the Grape and their control.**—*New York (Geneva) Agric. Exper. Stat. Bull.* 560, 14 pp., 3 figs., 1928.

The year 1928 is stated to have been marked by severe outbreaks of downy mildew of the vine [*Plasmopara viticola*] in the Finger Lakes district of New York State, and of the powdery mildew [*Uncinula necator*] in the south-western part of the State. This fact, together with the introduction in 1928 of State legislation regulating the grading of grapes, caused a large number of commercial vine-growers to apply for advice as to the most efficient and cheapest means of control of the two diseases. Field observations and experiments conducted since 1911 at Urbana, New York, indicate that spraying the vines with home-made 4–4–50 Bordeaux mixture is still the best treatment against both mildews, from the point of view of efficacy, absence of injury to the foliage, and cost. Three applications of the mixture should be sufficient to control the downy mildew in the Finger Lakes district in most seasons, while two treatments will control the severest outbreaks of powdery mildew in south-western New York, with probably one additional spraying in the Niagara district. For the early season treatments an addition to the mixture of a spreader, such as resin fish oil soap or menhaden fish oil, is desirable, but later in the season it should be omitted because of the risk of spray residues on the grapes. The treatment recommended against downy mildew will also control outbreaks of black rot [*Guignardia bidwellii*] in the Finger Lakes district.

MARSAIS (P.). **Le court-noué.** [Court noué.]—*Rev. de Vitic.*, lxx, 1801, pp. 5–7, 1 col. pl., 1929.

In this paper [which is illustrated by a useful coloured plate] the author briefly describes the symptoms of court noué of the vine

[*R.A.M.*, viii, p. 13] and brings forward evidence which indicates that two forms of the disease exist, one parasitic and the other physiological.

BIFFEN (R. H.). **Annual Report for 1928 of the Botanist.**—*Journ. Roy. Agric. Soc. of England*, clxxxix, pp. 308–315, 1928. [Received May, 1929.]

The following references of phytopathological interest occur in this report. The first symptoms of potato blight (*Phytophthora infestans*) in 1928 were observed on imported Jersey potatoes during the first week in May, and a fortnight later diseased foliage was received from Cornwall. Weather conditions, however, effectively checked any further spread of infection.

Apple mildew [*Podosphaera leucotricha*] was extremely prevalent and the infection persisted as late as November, when young shoots and foliage covered with spores were found.

Canker [*Nectria galligena*] was reported both on old apple trees and on some vigorous young espalier Allington Pippins. In the latter case the disposition of the cankers, at intervals along the main stem, suggested their origin in wounds caused by supporting ties.

An obscure disease of strawberries, bearing some resemblance to the 'degeneration diseases' of potatoes, was widespread. There is some evidence that the infective principle or principles may persist for some time in the soil, so that new stocks of healthy runners should be planted only on uninfected soil.

Mildew of swedes [*Erysiphe polygoni*] occurred in a severe form in some large areas, particularly on seedlings. Under rainy conditions the crop usually outgrows the disease but in dry weather the mildew continues to spread and may kill the plants.

The wheat disease ('whiteheads') ordinarily attributed to *Ophiobolus* [*graminis*: *R.A.M.*, vii, p. 490] is thought to be possibly due in part to other causes, e.g., to *Leptosphaeria* [*herpotrichoides*], which was found to have killed some 30 per cent. of the crop in a field near Cambridge. The disease was especially prevalent on plots receiving applications of sulphate of ammonia.

SĂVULESCU (T.). **Notes phytopathologiques pour l'année 1928 en Roumanie.** [Phytopathological notes for the year 1928 in Rumania.]—*Rev. Path. Vég. et Ent. Agric.*, xvi, 1, pp. 26–28, 1929.

Brief notes are given in popular terms on the distribution and severity of cereal rusts (*Puccinia* spp.) in Rumania during 1928. In the first few days of June there was a severe epidemic affecting all varieties of wheat, *P. triticina* appearing suddenly on autumn wheat throughout the Danube valley. *P. graminis* appeared on the same crops about 25th June and on 27th a few spots of *P. glumarum* were found. *P. triticina* was first noted in Transylvania a few days later than in the Danube valley and was quickly followed by *P. glumarum*, which caused from 20 to 30 per cent. loss. In Muntenia and Oltenia [Wallachia] *P. triticina* appeared early in June, causing losses of from 15 to 20 per cent., and being followed towards harvest time by *P. graminis* and *P. glumarum*. In

March, the lesions of *Septoria passerini* [*R.A.M.*, ii, p. 356] with those of *P. simplex* were noted on the lower parts of the stems and leaves of autumn barley.

Towards 15th May, peas in the Danube valley were severely attacked by various species of *Fusarium*, *F. vasinfectum* var. *pisi* being isolated from the diseased plants; in some districts the losses ranged from 30 to 40 per cent. This is stated to be the first record of *Fusarium* wilt of peas in Rumania, the late frosts of 1928 being, apparently, an important predisposing factor.

JANKOWSKA (KRYSTYNA). **O nowych dla Polski chorobach roślin uprawnych.** [Notes on diseases of cultivated plants new to Poland.]—Reprinted from *Roczniki Nauk Rolniczych i Leśnych* [*Yearbook of Agric. and Sylvicult. Sciences*], Poznań, xxi, 10 pp., 1929. [English summary.]

Brief notes are given in this paper on the following three diseases of cultivated plants which, so far as the author is aware, are new records for Poland.

Onion smut (*Urocystis cepulae*) broke out in 1928 in epidemic form in one locality. The intensity of the attack indicates that the fungus must have occurred sporadically in that area for several years previously without causing noticeable damage to the crop. The recent severe outbreak was presumably caused by the very dry weather which prevailed in 1928, and which, by weakening the onion plants, rendered them more susceptible to the fungus. Since, so far, no resistant varieties of onion are known, the only means of control that can be recommended are the immediate removal and destruction by fire of all diseased plants in the fields, crop rotation of several years' duration, and disinfection of the soil with formalin or with a mixture of sulphur and lime [*R.A.M.*, iii, pp. 130, 249].

Some damage was done in 1927 and 1928 in fields of buckwheat [*Fagopyrum esculentum*] in the neighbourhood of Puławy by a downy mildew similar to that described in 1910 by Ducomet from Brittany as being caused by a species of *Peronospora* closely related to, if not identical with, *P. effusa*. The fact, however, that while the fungus on buckwheat may be referred to this composite species on the basis of its morphological characters, Ducomet failed to secure infection with it on a number of species of *Polygonum* and *Rumex*, leads the present author, in agreement with Siemaszko, to separate it as a distinct species, which is named *P. ducometi* Siemaszko et Jankowska, and a detailed description of which, including a Latin diagnosis, will be shortly published. On buckwheat the fungus forms greenish-yellow spots, frequently involving one-half of the leaf, and bearing on the under side a rather loose, grey efflorescence of conidiophores which emerge through the stomata either singly or in groups of two or three. The conidiophores are branched at an acute angle in the upper third of their height, and average from 300 to 400 by 8 to 10 μ in diameter, the terminal, fine branchlets diverging at a right angle and being 5 to 10 μ long. The conidia are grey, oval, and measure on an average from 23 to 25 by 15 to 16 μ. Oospores were not observed. So far, the disease in Poland is of minor economic importance, but it should

be carefully watched as it might become dangerous under favourable conditions.

The third record is that of a bacterial disease of tobacco, the symptoms of which are identical with those of the American wildfire [*Bacterium tabacum*: *R.A.M.*, vii, p. 810; viii, p. 341]. Isolations from diseased tissues yielded a mobile, Gram-negative rod, with rounded ends, occasionally occurring in pairs, and averaging 2 to 4 by 0·8 to 1 μ in diameter. On peptone-grape sugar agar it formed irregular colonies of a dirty white colour. It did not form endospores. The pathogenicity of the organism was proved by successful inoculation of healthy tobacco seedlings. The development of the disease in the field appeared to be favoured by damp conditions, and several cases were observed in which leaves exhibiting the initial symptoms of infection entirely recovered on the onset of dry weather towards the end of July, 1928.

CUNNINGHAM (G. H.). **The New Zealand Plant Research Station. Current mycological investigations.**—*New Zealand Journ. of Agric.*, xxxviii, 1, pp. 1–9, 5 figs., 1929.

After indicating the general scope of the work undertaken by the Plant Research Station recently established at Palmerston North, New Zealand, the author briefly reviews investigations conducted by the mycological staff upon the control of seed-borne diseases of various [named] economic crops, with a view to the production of disease-free nucleus lines of pedigree agricultural seeds.

NOBLE (R. J.). **Australia: plant diseases observed in New South Wales.**—*Internat. Bull. of Plant Protect.*, iii, i, pp. 6–7, 1929.

During the year ending 30th June, 1928, psorosis or scaly bark [*R.A.M.*, v, p. 297], brown rot (*Phytophthora hibernalis*) [ibid., v, p. 295], and black pit (*Bacterium* [*Pseudomonas*] *citriputeale*) [ibid., viii, pp. 235, 236] of citrus were recorded for the first time in New South Wales.

Angular leaf spot of beans [*Phaseolus vulgaris*], caused by *Isariopsis griseola*, occurred in a mild form late in the season.

MCRAE (W.). **India: new diseases reported during the year 1928.**—*Intern. Bull. of Plant Protect.*, iii, 2, pp. 21–22, 1929.

The following diseases were reported in the Madras Presidency for the first time in 1928. A species of *Gloeosporium* was found to be the primary cause of a shoot rot of coco-nuts during the heavy monsoon rains. Good control was effected by the removal and destruction of infected shoots, painting the cut ends with coal tar, and cutting through the fibres to facilitate the emergence of the shoot.

Macrophomina phaseoli, the pycnidial stage of *Rhizoctonia bataticola* [*R.A.M.*, viii, p. 88], was discovered on wilted plants of *Phaseolus mungo* var. *radiatus*, *Arachis hypogaea*, and *Hibiscus cannabinus*, the genetic connexion between the two forms of the fungus being established in culture.

A mottling disease closely resembling mosaic was observed on *Eleusine coracana*, which was also attacked by *Sclerotium rolfsii* in the Vizagapatam district.

An undetermined species of *Fusarium* was responsible for a wilt of *Cicer arietinum* in the Coimbatore and Bellary districts.

A species of *Alternaria* was found causing much damage in experimental plots of linseed at Cawnpore.

Rugose mosaic, characterized by dense corrugation of the young unopened leaves and by wavy margins or uneven, chlorotic surfaces of the laminae of mature leaves, was observed in some thick sugarcane varieties. In the older leaves the rugosity is replaced by severe mottling.

The Government Mycologist in Burma reports the occurrence of mosaic and *Oidium* '*erysiphoides*' on *Capsicum annuum*.

MARTIN (G. H.). **Diseases of forest and shade trees, ornamental and miscellaneous plants in the United States in 1927.**—*Plant Disease Reporter*, *Supplement* 65, pp. 400–437, 2 maps, 1928. [Mimeographed. Received May, 1929.]

Of the many interesting items in this report (prepared on similar lines to those of previous years) [*R.A.M.*, vii, p. 493] the following only can be mentioned here. Larch canker (*Dasyscypha calycina*) [ibid., vii, pp. 285, 686] occurred in Connecticut on *Larix laricina* and was also reported from Massachusetts, Montana, New Jersey, Michigan, Idaho, and Washington. *D. fuscosanguinea* was observed to form cankers, which killed the affected parts, on *Pinus albicaulis* in British Columbia. *D. calyciformis* was observed in three cases in a secondary capacity on *P. monticola* trees attacked by *Cronartium ribicola* in British Columbia.

Douglas firs (*Pseudotsuga douglasii*) [*P. taxifolia*] in Washington were attacked by *Phomopsis* sp., which produced cankers and killed the top or side branches.

Verticillium wilt of maples (*Acer* spp.) [ibid., v, p. 641] was reported from a number of States. During the period under review one Norway and one sugar maple [*A. platanoides* and *A. saccharum*, respectively] were apparently killed by a combination of illuminating gas and *Verticillium*. Some trees with the fungus in the trunk and branches have lost no limbs for the past eight years, though growth has been slow. The usual progress of the disease is much more rapid. In a few instances the *Verticillium* fungus has been isolated from sap wood which showed none of the usual green or dark streaks. In Berkeley's cultural studies of the forms of *Verticillium* in Canada, three isolations from maple were placed in the species *V. ovatum* while one is simply classed as *V.* sp. in a strain group by itself [ibid., vii, p. 301].

Leaf blight of *Amelanchier glabra*, caused by *Fabraea maculata*, was reported for the first time from Bozeman, Montana.

A survey of blight (*Endothia parasitica*) -resistant chestnut (*Castanea dentata*) trees in Pennsylvania and West Virginia showed that certain individuals have survived the attacks of the fungus, and a study of the factors accounting for this resistance is in progress. A map is given showing the distribution of chestnut blight and the estimated percentage of infected trees in January, 1928.

At the time of writing, not one of the 200 chestnut-producing counties in the Southern Appalachians had an estimated infection less than 1 to 9 per cent. [ibid., vii, p. 685]. Only four counties in Tennessee and 19 in Kentucky are now in the 1 to 9 per cent. group, and in a year or two even these are expected to rise to the 10 to 29 per cent. class. By the end of 1930 it is anticipated that most of the 110 counties of the Southern Appalachians now showing less than 60 per cent. infection will reach this figure, representing the point at which dead chestnut trees begin to appear in most stands. The disease has been reported from Iowa, where it must have resulted from an importation of infected nursery stock from the east. The fungus was further observed near Birmingham, Alabama, where the spores were probably disseminated by natural means from blighted regions in south-eastern Tennessee or north-western Georgia.

Japanese flowering crab (*Malus floribunda*) [*Pyrus pulcherrima*] was generally infected by *Gymnosporangium germinale* in Connecticut [ibid., viii, p. 387], this being apparently the first record of its occurrence on this host.

Bulgaria polymorpha (Oud.) Wettst. was frequently observed on oaks (*Quercus* spp.) on Long Island, New York. The fungus is apparently parasitic under certain conditions; in the final stages, at any rate, it causes rapid decay of the bark and cambium tissues.

Ascochytella asparagina Petrak caused a hitherto undescribed blight of asparagus fern (*Asparagus plumosus*) in New York.

Delphinium sp. in a Kentucky nursery was heavily infected by a form of ring spot closely resembling that of tobacco [ibid., vii, p. 477]. At Logan, Utah, the tall perennial varieties showed 50 per cent. infection by yellows, characterized by chlorosis and leafy proliferation of the floral parts.

Dianthus allwoodii and *D. caesius* suffered from anthracnose (*Volutella dianthi*), this being the first record submitted to the Plant Disease Survey.

Hydrangea mildew (*Oidium*) [*hortensiae*] was reported for the first time from Virginia (on the Marshal Foch and Splendens varieties) and Utah, where it has been observed in a wild form for 15 years by a florist propagating his own stock; the disease also occurred in Connecticut [cf. ibid., viii, p. 108].

Rhododendron maximum in New Jersey was affected for the first time by a leaf spot due to *Guignardia* sp. *Laestadia rhodorae*, probably the imperfect stage of this fungus, had previously been reported from New York.

Crown wart of *Lathyrus sulphureus*, caused by *Urophlyctis lathyri*, was reported from Oregon for the first time.

Plant diseases.—*Forty-first Ann. Rept. Georgia Agric. Exper. Stat. for the year 1928*, pp. 23–27, [1929.]

Cultures of various organisms isolated from the interior of rosetted peach twigs were inoculated into the bark of healthy young peach trees during the winter of 1927–8, but so far no symptoms of the disease have appeared [*R.A.M.*, viii, p. 90]. The insertion of crushed bark from rosetted twigs also gave negative results. The

disease is readily transmitted to healthy trees by the insertion of rosetted buds, but the infective principle appears to spread very slowly or not at all during the hot weather, possibly owing to inactivation by high temperatures or else to the low concentration of nutrients in the wood during the season of active growth.

Promising results in the control of *Sclerotium rolfsii* on pepper [*Capsicum annuum*] were obtained by the application to the base of the plants of the preparation known as Du Pont K.I.P.

Excellent control of the angular leaf spot of cotton [*Bacterium malvacearum*] was secured by treating the seed with 20 per cent. mercuric chloride dust (4 oz. per bushel), mercuric resinate dust (saturated), and Du Pont dust No. 12 (4 oz. per bushel), without delinting, as well as by 30 minutes' immersion in mercuric chloride after delinting with sulphuric acid. The last-named treatment, however, caused a considerable reduction of yield. None of these treatments proved effective in the control of cotton root rot (*Fusarium moniliforme*) [*Gibberella moniliformis*: ibid., vi, p. 609], the seedlings in the test plots showing nearly 100 per cent. infection due to the presence of the organism in the soil.

In connexion with an exhaustive study of downy mildew of Cucurbitaceae, caused by *Pseudoperonospora cubensis* [ibid., vii, p. 295], a series of field experiments in the control of this disease on cantaloupes was conducted. Fairly good results were given by spraying with Bordeaux mixture, copper acetate, or colloidal copper at various concentrations, but in some cases severe burning of the foliage occurred. Copper acetate ($\frac{1}{3}$–50) was found to be very effective and causes practically no damage to the plants.

Kansas Agricultural Experiment Station, Director's Report for the biennium July 1, 1926, to July 30, 1928.—153 pp., 1 fig., 3 maps, 1928. [Received March, 1929.]

The following items of phytopathological interest occur in this report. No correlation between the water requirements of tomatoes and the incidence of blossom-end rot [*R.A.M.*, vii, p. 747] was found in a test comprising the Louisiana Red variety (*Lycopersicum esculentum vulgare*), Red Pear and Yellow Plum (*L. pyriforme*), and Red Cherry (*L. cerasiforme*). In general, varieties with smaller fruit appear to be more resistant, the Red Cherry, for instance, being entirely immune.

It was found impossible to control potato scab [*Actinomyces scabies*] by the application to the soil of sulphur, alone or in combination with green manure. In Kansas, as in other parts of the United States, the corn-seed maggot [*Phorbia cilicrura*] has been found to transmit blackleg [*Bacillus atrosepticus*] from diseased to healthy potatoes [ibid., viii, p. 331]. Coating the seed-pieces with mercuric poisons was found to reduce the disease by destroying the insect vectors. A correlation was observed between the occurrence of late-season infection by blackleg and the presence of lesions due to *Rhizoctonia* [*Corticium solani*], which appear to attract the maggots. Plants grown from seed-potatoes affected by spindle tuber were found to yield 25 to 60 per cent. less than healthy ones. The disease was found to be transmissible by the

cutting knife [ibid., viii, p. 394] and through the agency of certain insects.

Soil temperatures between 40° and 60° F., together with adequate soil moisture (20 to 30 per cent.), seem to be the most favourable conditions for bunt [*Tilletia levis*] infection in winter wheat [cf. ibid., vii, p. 774]. Immersion in, or sprinkling with, formaldehyde gave the best results with heavily smutted seed-grain. Where the soil is extensively contaminated bunt occurs even on copper carbonate-treated seed, which was also found to contract infection as a result of reinoculation.

Several varieties and hybrids of winter and spring wheats have shown consistent resistance to leaf rust [*Puccinia triticina*]; among these may be mentioned Kawvale, Kanred × Fulcaster, Kanred × Hard Federation, and Kanred × Prelude. In 1925, 1926, and 1927 severe autumn infections were reported. The fungus survived the winter of 1926–7 as far north as Manhattan, but in 1925–6 and 1927–8 it failed to withstand normal winter field conditions. The prevailing strong south winds of April and May apparently carry many rust spores into Kansas from northern Texas and Oklahoma [ibid., viii, p. 364]. The physiological form IX of *P. triticina* [ibid., v, p. 477] is the most widely distributed in the south-west; resistance to this strain has been studied in the F_1 to F_3 generations of 15 crosses in the greenhouse and appears to be recessive in most cases with a single main factor difference. Of the 45 cultures of rust from various parts of the south-west examined during 1926–7, 20 were composed entirely of form IX, while the remainder consisted mainly of this form with slight admixtures of others; forms V, XI, and several undetermined ones were also isolated. Some strains of wheat, mostly belonging to the soft red winter type, have been isolated from 28 out of 200 varieties tested in the greenhouse as showing resistance to form IX. Several varieties and many hybrid lines have proved susceptible to this form in the seedling stage of growth but highly resistant at heading time.

Inbred lines of several standard maize varieties have been found to differ greatly in susceptibility to smut [*Ustilago zeae*] under field conditions; some of those from Commercial White, Pride of Saline, and Kansas Sunflower have shown very little smut when exposed to natural infection during the last three years. Even highly resistant lines, however, contract the disease when hypodermally inoculated, suggesting that there may be no true protoplasmic immunity from smut.

The finer grades of sulphur dust proved almost equally efficient with copper carbonate in the control of kernel smut of sorghum [*Sphacelotheca sorghi*]. The heaviest infections with this fungus were obtained in May plantings at Manhattan. Two physiological forms of the fungus have been found (besides the common form), both capable of attacking one or more of the supposedly immune milo, hegari, and feterita varieties.

Millet [*Setaria italica*] smut [*U. crameri*] has proved amenable to treatment by copper carbonate dusts [ibid., viii, p. 234] but not to sulphur.

Among 38 apple varieties tested for their reaction to cedar-apple

rust [*Gymnosporangium juniperi-virginianae*], Northwestern, Yellow Transparent, and the Winesap group proved resistant while Wealthy and Jonathan were highly susceptible.

TUCKER (C. M.). **Report of the Plant Pathologist.**—*Rept. Porto Rico Agric. Exper. Stat. 1927*, pp. 25–27, 1929.

During the period under review the *Phytophthora* collection has been considerably enlarged and now contains some 125 strains from nearly all the principal hosts of the genus. Observations on the ability of strains to withstand winter conditions in the temperate zone show a correlation between this faculty and oospore production. The presence of oogonia and oospores was detected in pure cultures of two strains of *P. palmivora* [*R.A.M.*, vii, p. 602], this being apparently the first record of the occurrence of sexual spores in pure cultures of the species. Continued observations on coco-nut palms inoculated with a strain of *P. palmivora* isolated from *Sabal causiarum* have definitely established its pathogenicity [ibid., vii, p. 228]. Inoculations of 10 unwounded 15- to 20-year old coconut palms resulted in the death of 8 with typical symptoms of bud rot.

Bryophyllum pinnatum and avocado are two new hosts of *Phytophthora* in Porto Rico. The former plant develops water-soaked areas on the leaves, which finally blacken and rot. Affected avocado trees are characterized by scanty, small, pale green foliage and by a conspicuous blackening of the roots resembling the description of the ink disease of chestnuts [*P. cambivora*] in France and Italy. In some cases infection occurred near the root tips and caused them to die back, while in others lesions appeared at any point on the bark. The cortical and cambial tissues were destroyed, but the discoloration did not extend deeply into the wood. The fungus produced a decay of apple tissue closely resembling that due to *P. cactorum* [ibid., iv, p. 615] and was readily isolated from the fruit.

A root disease of citrus, which is very prevalent along the north coast of the island, was investigated. The symptoms observed at different places include scantiness and discoloration of the foliage, more or less severe crown rot, occasional heart and root rot, and die-back of the branches. The affected trees were usually found to be growing in close proximity, indicating that infection passes from diseased to healthy individuals. No correlation was found between soil types or moisture conditions and the incidence of infection. A fungus nearly allied to *Colletotrichum gloeosporioides* was consistently isolated from diseased branches, while the infected root tissue invariably yielded a species of *Fusarium*, with which, however, the author has, so far, obtained no evidence of pathogenicity.

SAGEN (H. E.), WRIGHT (W. H.), & RIKER (A. J.). **The cultural differentiation of B. radiobacter (Beij.) and closely related organisms.**—*Journ. of Bact.*, xvii, 1, pp. 22–23, 1929.

This is an abstract of a paper read before the thirtieth annual meeting of the Society of American Bacteriologists, 27th to 29th December, 1928.

Cultural studies of *Bacillus radiobacter*, *Bacterium tumefaciens*, and a number of the legume root nodule bacteria are stated to reveal differences in respect of motility, morphology, absorption of dyes, reduction of nitrates, serological properties, growth in litmus milk, and growth on glycerophosphate media, the last-named being specially characteristic.

In a glycerophosphate medium with mannitol as the source of carbon, *B. radiobacter* developed an abundant growth with a conspicuous brown halo round the streaks on agar plates; a whitish precipitate formed near the streaks. *Bact. tumefaciens* produced neither halo nor precipitate under the same conditions.

The *B. radiobacter* cultures failed to absorb Congo red, while the typical crown gall cultures did so. The organisms closely related to *Bact. tumefaciens* that are responsible for hairy root [*R.A.M.*, viii, p. 159] did not absorb Congo red to any appreciable extent and made no growth on glycerophosphate media.

In litmus milk cultures of several weeks' incubation at 28° C. the hairy root organisms produced enough acid to turn the litmus, and it was often reduced, with coagulation of the casein of the milk. None of the *B. radiobacter* or *Bact. tumefaciens* cultures changed the reaction of the milk, which retained its characteristic greyish-brown colour with a conspicuous serum zone.

The typical crown gall organisms invariably exhibit Brownian movements, and do not appear to possess flagella. The *B. radiobacter* strains were actively motile, with longer cells than the crown gall or hairy root organisms, and showed one polar flagellum, often attached at a corner of the cell.

Serological studies of many strains of the organisms in all three groups showed no inter-agglutination relations. The true crown gall strains were homologous in the same way as those of hairy root and *B. radiobacter*; there was no sub-division of any of the strains within a group or any tendency towards cross-agglutination.

RANE (L.). **Virulence, electrophoresis, and conversion characteristics of Bact. phaseoli sojense, S. and R.**—*Proc. Soc. Exper. Biol. & Med.*, xxiv, 4, pp. 299–301, 1929.

The author has investigated the conditions governing the conversion of rough to smooth and smooth to rough colony strains of *Bacterium phaseoli* [var.] *sojense* [*R.A.M.*, vi, pp. 458, 650].

The best growth of the organism occurred at 30° C., at which temperature the rough and smooth strains remain stable. At higher temperatures (up to 37·5°), the smooth strains are partially converted into rough ones. Growth in nutrient broth of a hydrogen-ion concentration between P_H 5·2 and 8·8 failed to change the colony form. Culture in broth containing 1 to 2 per cent. homologous (smooth) anti-serum (rabbit) results in the partial conversion of smooth to rough, whereas in broth containing 10 per cent. anti-serum, the conversion of smooth to rough forms is rapidly and almost completely effected. A similar conversion is produced by growth in peptone water containing 2 to 15 per cent. peptone, and is probably complete in the 10 to 15 per cent. solutions. Culture in the presence of homologous (rough) anti-serum produces rapid but incomplete rough to smooth changes, and serial transfer to

broth containing 10 per cent. of this serum results in nearly complete transformation of the culture; on the other hand, growth in the broth alone or in the broth containing normal or heterologous (smooth) anti-serum produces no change. A striking and almost or entirely complete conversion of rough to smooth is effected by growth on glucose agar (0·3 to 20 per cent. glucose). This conversion does not occur in fluid glucose media (except when rapidly transferred), or in solid or fluid media containing other sugars. When converted into smooth by growth on solid glucose media an unusually large colony results, and is subsequently stable even on media lacking glucose. Experimental data [which are tabulated] showed that the rough-dextrose strains, i. e., those converted into smooth ones by growth on dextrose-containing media, behave more like the typical smooth than like the rough strains in virulence, agglutination, and electrical characteristics.

The following electrophoretic charges or potential differences for ten strains of each of the rough, rough-dextrose, and smooth cultures were obtained: rough 2·66 μ / sec. / volt / cm. (migrations to the anode); rough-dextrose 4·04; and smooth 4·21.

In one experiment the smooth and rough-dextrose cultures were found to be virulent to mice while the rough ones were not. The smooth and rough-dextrose strains were more virulent to Manchu soy-beans than the rough ones (98, 92, and 61 per cent. infection, respectively).

RIVERA (V.). **Influenza dei 'circuiti aperti' di Lakhovsky sullo sviluppo di tumori nei vegetali.** [The influence of Lakhovsky's open circuits on the growth of tumours in plants.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 4, pp. 357–373, 2 figs., 1 graph, 1928.

When *Pelargonium* and *Ricinus communis* seedlings inoculated with *Bacterium tumefaciens* were surrounded on a level with the lesion by an open circuit of copper wire isolated by an ebonite support [cf. *R.A.M.*, iv, p. 25; vii, p. 564] the effects upon the growth of the plants and tumours [which are fully discussed] were briefly as follows.

When the wire was placed round a *Pelargonium* seedling eleven days after inoculation, the growth of both plant and tumour was stimulated as compared with an inoculated but unencircled, closely adjacent control, which was sickly and stunted. On the former the tumour and the shoot bearing it died before those on the adjacent control, but in other inoculated controls placed at a greater distance from the wired plant the tumour and the shoot bearing it lived on.

When the open circuit was placed round a seedling of *R. communis* on the day of inoculation (17th June), the growth of the tumour was much accelerated, as compared with the control; when the wire was removed (10th July) the growth of the tumour was much slowed down. The circuit was then placed round another seedling, also inoculated on 17th June, and in this plant the growth of the tumour became increasingly retarded. In a third seedling, continuously surrounded by the wire from the date of inoculation, the rate of growth of the tumour steadily increased.

RIVERA (V.). **Trattamenti di tumori da 'Bacter. tumefaciens' sopra Ricinus con tubi di emanazione di radio.** [The treatment of tumours of *Bacterium tumefaciens* on *Ricinus* with radium emanation tubes.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 4, pp. 428–444, 5 figs., 1928.

A detailed account is given of experiments in which two-months-old *Ricinus* plants were inoculated at two points in one internode of the stem with *Bacterium tumefaciens*, a capillary tube containing radium emanation being subsequently applied to or inserted in one of the resultant tumours [cf. *R.A.M.*, ii, p. 493]. As the same tubes were used on different plants successively, the dosages given gradually decreased, their activity being reduced by about one-half every four days.

The results obtained showed that a dosage of (when first applied) approximately 12 millicuries (1 curie = the amount of radium emanation in equilibrium with 1 gm. of radium), continued for twenty-eight hours, on the one tumour, and one of 10 to 8 m.c. for forty-six hours on the other tumour of the same plant, or one of 12 to 10 m.c. for twenty-two hours on one tumour on another plant, killed the tumours and also the plants. In the second case no effect was observed on the rate of growth of the control tumour, which was rather more than 4 cm. distant from the tube. The death of the plants was due to the rays first inhibiting the growth and then causing necrosis of the healthy tissues in the part of the stem exposed to the rays. In both plants the area exposed to the rays ceased to increase in diameter, indicating that the cambial meristem was severely affected. The stronger dose killed the plant in 14 days and the weaker in 28 days.

An initial dosage of 6 m.c. continued for forty-eight hours arrested the growth of the tumour almost immediately, and though the exposed part of the stem ceased to grow, the plant lived for nearly three months. The tissue at the lower extremity of the control tumour, 1·5 cm. above the tip of the emanation tube, showed slight necrosis.

Initial doses of 3 to 4 m.c. continued for six days arrested the growth of the tumour and reduced its size, but produced slight necrosis in the healthy tissues nearest to the rays. This area became rapidly cicatrized.

The weakest dosage (initially little more than 1 m.c.) continued for 13 days resulted in complete cure. The growth of the tumour was at once arrested, though it resumed feeble growth for one week after the tube was removed, and afterwards shrank to approximately one-half the size of the control tumour.

FREEMAN (W. G.). **Witch-broom disease. A reply to criticisms.** —*Trop. Agriculture*, vi, 2, pp. 55–56, 1929.

In this paper the author replies to criticisms advanced by Briton-Jones of the measures applied by the Department of Agriculture of Trinidad and Tobago, as described by Stell [*R.A.M.*, viii, p. 160], for the control of the witches' broom disease of cacao [*Marasmius perniciosus*] in the areas under its jurisdiction. In briefly reviewing the methods employed for the eradication of the disease and for the sanitation of the plantations, he points out that they are

based on the results of research work carried out in other countries, especially in Surinam, where the disease is rife. These methods are applied in Trinidad in so far as the somewhat small staff at the disposal of the Department of Agriculture renders it possible, with some slight deviations according to the particular conditions of each locality affected.

BRITON-JONES (H. R.). **Witch-broom disease.**—*Trop. Agriculture*, vi, 2, p. 57, 1929.

Continuing the discussion on the control of the witches' broom disease of cacao [*Marasmius perniciosus*: see preceding abstract], the author reviews some of the methods used in Trinidad, and substantiates his views with some further arguments, while acknowledging the energetic manner in which the Department of Agriculture has applied itself to the difficult task of suppressing the disease. In particular he is opposed to burying the diseased prunings and to the use of tar as a wound dressing.

PEYRONEL (B.). **Malattie del Grano. i. Mal del piede.** [Wheat diseases. i. Foot rot.]—*Boll. Fitopat. e Ent. Agraria, Min. Econ. Naz.*, i, 23 pp., 12 figs., 1927. [Received February, 1929.]

An account is given in popular terms of the symptoms, predisposing factors, and control of the different forms of foot rot of cereals caused in Italy by *Ophiobolus graminis*, *O. herpotrichus*, *Leptosphaeria herpotrichoides*, and *Fusarium* spp.

PETRI (L.). **Malattie del Grano. ii. Le ruggini.** [Wheat diseases. ii. Rusts.]—*Boll. Fitopat. e Ent. Agraria, Min. Econ. Naz.*, ii, 27 pp., 2 col. pl., 8 figs., 1927. [Received February, 1929.]

An account [illustrated by two excellent coloured plates] is given in popular terms of the wheat rusts caused by *Puccinia graminis*, *P. glumarum*, and *P. triticina*, together with notes on predisposing factors and on the control of these diseases by the destruction of alternate hosts and the planting of resistant varieties.

FERRARIS (T.) & GABOTTO (L.). **Malattie del Grano. v. Golpe bianca. vi. Mal bianco degli steli. vii. Micosi delle spighe. viii. Grano sprone.** [Wheat diseases. v. White blight. vi. White straw disease. vii. Plumed spore disease. viii. Ergot.]—*Boll. Fitopat. e Ent. Agraria, Min. Econ. Naz.* iii, 31 pp., 12 figs., 1927. [Received February, 1929.]

An account is given [by Ferraris] in popular terms of cereal blight (*Gibberella saubinetii*), the white straw disease of wheat (*Gibellina cerealis*), which occasionally causes slight damage in Italy, plumed spore disease (*Dilophospora graminis*) [*D. alopecuri*], not yet definitely reported on wheat in the same country, and [by Gabotto] of ergot (*Claviceps purpurea*), suitable control measures being recommended in each case.

BONGINI (V.), SIBILIA (C.), & VOGLINO (P.). **Malattie del Grano. ix. Nebbia. x. Nerume. xi. Septoriosi.** [Wheat diseases. ix. Mildew. x. Black mould. xi. Septoriosis.]—*Boll. Fitopat. e Ent. Agraria, Min. Econ. Naz.*, iv, 26 pp., 20 figs., 1927. [Received February, 1929.]

Notes are given in popular terms on the symptoms, causal organisms, predisposing factors, and control of wheat mildew (*Erysiphe graminis*) [by Bongini], the black mould of cereals [by Sibilia] caused by various fungi, including *Cladosporium herbarum*, *C. graminum*, *Alternaria tenuis*, *Acremoniella occulta* [*Nigrospora oryzae*: *R.A.M.*, vi, p. 758], and *A. verrucosa*, and on cereal blight associated with different species of *Septoria* [by Voglino].

GABOTTO (L.). **Malattie del Grano. Alterazioni non parassitarie. Danni della grandine.** [Wheat diseases. Non-parasitic lesions. Hail injury.]—*Boll. Fitopat. e Ent. Agraria, Min. Econ. Naz.*, v, 16 pp., 7 figs., 1927. [Received February, 1929.]

A description is given in popular language of the various injuries to wheat that are caused by hail, and of others, due to physiological influences or insect attack, which are commonly confused with them.

HOMMA (YASU). **A statistical study on the biological forms of Erysiphe graminis DC.**—*Trans. Sapporo Nat. Hist. Soc.*, x, 2, pp. 157–161, 4 figs., 1929.

During the summer of 1928 the writer made a comparative study, based on differences in conidial dimensions, of the morphology of various biological forms of *Erysiphe graminis* [*R.A.M.*, iv, p. 315] on material collected at and near Sapporo, Japan. Three of the forms encountered agreed with biological forms already recognized by earlier investigators, namely, that on common wheat (*E. graminis* f. sp. *tritici*), on naked barley (f. sp. *hordei*), and on *Poa annua* (f. sp. *poae*), while the form on *Elymus mollis* (f. sp. *elymi*) is a new form proposed by the writer. The average dimensions of 500 conidia of the first three forms and of 100 of the last were found to be as follows: f. sp. *tritici* $37{\cdot}35 \pm 0{\cdot}037$ by $14{\cdot}50 \pm 0{\cdot}035\ \mu$; f. sp. *hordei* $35{\cdot}45 \pm 0{\cdot}078$ by $14{\cdot}64 \pm 0{\cdot}040\ \mu$; f. sp. *poae* $31{\cdot}00 \pm 0{\cdot}054$ by $16{\cdot}31 \pm 0{\cdot}043\ \mu$; and f. sp. *elymi* $26{\cdot}67 \pm 0{\cdot}144$ by $13{\cdot}84 \pm 0{\cdot}068\ \mu$. There are, therefore, appreciable morphological differences between the various biological forms.

JODIDI (S. L.) & PEKLO (J.). **Symbiotic fungi of cereal seeds and their relation to cereal proteins.**—*Journ. Agric. Res.*, xxxviii, 2, pp. 69–91, 1929.

In the introductory part to this paper reference is made to the junior author's earlier cytological work in London and Prague (the results of which were published in *Ber. Deut. Bot. Gesellsch.*, xxxi, pp. 370–384, 1913), which led him to the conclusion that the so-called aleurone layer and other constituents of cereal and grass seeds are produced by symbiotic fungi, and that the aleurone grains in the aleurone layer and in the embryo represent offshoots of their hyphae and arise from minute hyphal prominences. He

also found that in older seeds, the hyphal masses were greatly swollen and mucilaginous, and constituted a great part, if not the whole, of the gluten contents of the endosperm. In London he studied exclusively young seeds of English ryegrass (*Lolium perenne*), for the reason that this plant contains the symbiotic fungus not only in the aleurone layer and in the endosperm, but also between the aleurone layer and the seed-coat, where it forms a distinct mycelium. About 25 per cent. of the material examined contained well-developed intercellular fungous layers, which were aseptically separated and transferred to urea gelatin, on which the fungus developed and showed the mycelial characters, sporidia, nuclei, and black, thick-walled chlamydospores characteristic of a smut. In Prague, the symbiotic fungi were isolated from a soft winter wheat, three varieties of spring barley, and one variety of winter rye, all of which were grown in Czecho-Slovakia. On sectioning it was found that in the young seeds of these cereals the contents of the aleurone cells consist of fungal hyphae and that the so-called aleurone grains represent their products. The fungi isolated from these seeds could only be cultured in nutrient solutions containing the native proteins of the corresponding cereal, on which they grew very profusely. When examined *in vivo*, they showed the presence of large nuclei with a structure characteristic of smuts, and occasionally copulated as smut sporidia do; frequently they produced short or longer filaments with very peculiar, star-like ramifications. From all these considerations it is concluded that these fungi must be regarded as a new type of symbiotic smuts, different from any of the hitherto known species of parasitic smuts.

Biochemical tests [full details of which are given] showed that the symbiotic fungi of English ryegrass, wheat, and barley, when grown in culture, contain the proteins known to occur in the seeds of these three plants, respectively, and also prolamin, an essential component of gluten. The proportions of prolamin nitrogen found were: in the ryegrass fungus 0·43 and 9·51 per cent.; in the wheat fungus 0·12 and 6·47 per cent.; and in the barley fungus 0·19 and 5·35 per cent., calculated on the basis of the oven-dried fungus, and of its total nitrogen, respectively.

Săvulescu (T.) & Rădulescu (I.). **Studiul agronomic al ruginilor la grânele Româneşti. Rezultate şi concluziuni din campania de lucru a anului 1928.** [Agricultural study of cereal rusts in Roumania. Results and conclusions of the work carried out in 1928.]—Reprinted from *Viaţa Agricola, 1928,* 3-4, 16 pp., 1 graph, 1929. [French summary.]

Details are given of observations made during 1928 near Bucarest on the development of wheat rusts (*Puccinia triticina*, *P. graminis*, and *P. glumarum*), with a view to determining the relative resistance to these fungi of the wheat varieties mainly cultivated in that region [see above, p. 421]. The first to appear was *P. triticina*; it broke out intensively on the leaves in the period from the 1st to 5th June, and rapidly spread to the sheaths, stems, and ears, retaining, however, a maximum of intensity on the leaves. *P. graminis* and *P. glumarum* appeared some 20 and 25 days later,

respectively, and developed with the greatest severity on North European and North American varieties of wheat and on their hybrids. Early maturing varieties appeared to be very slightly, if at all, attacked by *P. glumarum* on their leaves, sheaths, and stems, but their ears were somewhat more susceptible.

Observations made in the plots of two experimental stations showed that in some varieties and pure lines of wheat which, in the early stages of invasion, reacted in a different way to the rusts, the differences were smoothed out with time, the final results being practically the same. The highest degree of resistance was found in the following four pure lines, in decreasing order: 'Sandu' 398, 'Sandu' 120, 'Bz. 7', and 'Cipaianu'. Although some late maturing varieties, e.g., Filipescu, seemed to be more resistant at the beginning of the season, they proved in the end to be more injured by the rusts than earlier varieties. As a class, awned varieties appear to be more resistant than the awnless, since the rusts developed to a much greater extent on the awns than on the glumes, thus affording a measure of protection to the grain.

CHABROLIN (C.). **La rouille noire du Blé en Tunisie.** [Black rust of Wheat in Tunis.]—*Rev. Path. Vég. et Ent. Agric.*, xvi, 1, pp. 49–58, 1929.

Favoured by a wet spring, with unusually heavy rain in March, and cloudy periods with abundant dew, *Puccinia graminis* almost completely destroyed the wheat crop in Tunis in 1928, though in normal years the disease is seldom severe in this area, where it commonly causes less damage than *P. glumarum*. Oats and barley were scarcely affected. As no barberry is known in Tunis, and *Berberis aetnensis*, which is susceptible to the rust [*R.A.M.*, v, p. 723], does not grow farther east than the Jurjura mountains of Great Kabylia, some 500 km. to the west of the locality affected, which is also some 200 to 300 km. from Sicily and Sardinia, the aecidial stage of the fungus does not occur within a radius of several hundred km. from the area where the rust was found.

Cereal rusts occur in Tunis only in spring, and according to Petit (Communication à la Société des Agriculteurs de Tunisie, 17th October, 1928) each appears annually round about a particular date, *P. glumarum*, for example, being noted just before April. An examination of numerous volunteer stools of wheat, oats, and barley did not reveal a single rust pustule at the beginning of October or November. It must be concluded, therefore, that under local conditions the uredospores of the rusts cannot live during the summer either in the soil or on the grain; the Gramineae also all dry up during the hot months, so that the rusts are not likely to be carried over the summer on wild grasses.

The extent of the loss in 1928 was not seen until about the middle of May, when harvesting began. Early in that month the tops of the culms beneath the ears were covered with the teleutosori of *P. graminis*. In the most severely affected localities (20 to 30 km. south-west of Tunis) the losses ranged from 40 to 80 per cent., and even in the fields in these districts in which infection was lightest the yield obtained was only one-half that expected.

The most severely affected variety was the rather widely grown soft wheat, Mahon, the harvesting of which began about 25th May: Barletta and Richelle, which ripened a few days earlier, were much less affected, while Florence wheat (15 to 18 days earlier than Mahon) virtually escaped infection and gave good results, although adjacent to severely affected fields of Mahon. The most widely cultivated varieties, Biskri and Mahmoudi, in many places sustained a loss of 50 per cent.

REMY (T.) & MEER (F. v.). **Über das Wesen der Gelbrostschutzwirkung von Kalisalzdüngungen.** [On the nature of the protection against yellow rust afforded by fertilizing with potash salts.]—*Ernährung der Pflanze*, xxv, 4, pp. 73–77, 1 diag., 1929.

Further investigations and experiments [details of which are given] have been conducted at Bonn-Poppelsdorf on the effect of fertilizers on yellow rust of wheat [*Puccinia glumarum*: *R.A.M.*, vii, p. 499]. The beneficial effects of potash were again apparent, especially where the 40 per cent. potassium chloride salt was used, potassium sulphate giving noticeably inferior results in this respect. There appears to be a correlation between the high chloride content of the salt (acting, perhaps, by acidification of the cell sap) and the resistance to yellow rust of the treated plants.

DILLON WESTON (W. A. R.). **Resistance of Wheat varieties to bunt (Tilletia caries).**—*Nature*, cxxiii, 3094, p. 243, 1929.

In 1926 the Sherman variety of wheat, which has shown a high degree of resistance to bunt caused by *Tilletia caries*, was resown at Cambridge, one-half of the seed being contaminated with Little Joss bunt and the other with its own bunt. At the 1927 harvest the percentage of infection in the two plots was as follows: Sherman with Little Joss bunt, 8·1 diseased ears; Sherman with Sherman bunt, 85·7. The resistance to bunt of other varieties, e.g., Ridit, Turkey, Hussar, and Berkeley Rock, has since been broken down by the same method. Thus, Berkeley Rock, heavily contaminated in 1927 with Little Joss bunt, produced only 1·6 per cent. of diseased ears at harvest, compared with 91·1 per cent. when contaminated with its own bunt. It is apparent from these results (details of which are reserved for future publication) that a pathogen may be selected from a population to which the host is susceptible, in the same way as the plant breeder may choose a unit from a population of a host variety for resistance to a given pathogen.

JAGUENAUD. **Expériences de traitement à sec de la carie sur les Blés de printemps.** [Experiments in the dry treatment of bunt of spring Wheat varieties.]—*Prog. Agric. et Vitic.*, xcii, 3, pp. 62–63, 1929.

This report of experiments conducted in Tunis on the control of bunt of wheat [*Tilletia tritici* and *T. levis*] by seed dusting with

copper acetate has already been noticed from a paper by the present author and Schribaux [*R.A.M.*, viii, p. 299].

HOFFMANN (G.). **Die Bedeutung des Germisankurzbeizverfahrens für den kleinbäuerlichen Besitz.** [The importance of the germisan short disinfection process for small farms.]—*Tech. Landw.*, x, 2, p. 42, 1929.

This is a brief note on the advantages of the germisan short disinfection process [*R.A.M.*, viii, p. 229], whereby cereal seed-grain can be treated against seed-borne diseases with a minimum outlay of money, time, and labour. The estimated cost of the treatment per cwt. is Pf. 16 for rye (1 l. of a 1 per cent. germisan solution), and Pf. 24 for wheat (1 l. of a 1·5 per cent. solution).

CRÜGER (O.). **Fusskrankheit an Weizen, Roggen und Gerste.** [Foot rot of Wheat, Rye, and Barley.]—*Angew. Bot.*, xi, i, pp. 1–24, 1 map, 1929.

The writer has conducted a series of morphological and physiological investigations into the etiology of the foot rot of cereals (associated primarily with *Leptosphaeria herpotrichoides* and *Ophiobolus herpotrichus*), which occurred in a severe form in East Prussia during 1927 and 1928 [*R.A.M.*, vii, p. 626]. Wheat was more severely affected than rye, while barley suffered relatively little. A study of the influence of the preceding crop on the incidence of infection showed that, in general, wheat was most heavily attacked following barley or rye (especially the former) and least after peas, while fallow, rape [*Brassica napus*], wheat, potatoes, and oats were intermediate in their effects. Mixed vetch [*Vicia* spp.] and clover proved deleterious to the succeeding wheat crop when phosphoric acid and potash were not applied in sufficient quantities, while beets were unsuitable before wheat on light diluvial soil. No direct correlation could be traced between the quantity of phosphoric acid in the straw and the healthy or diseased condition of the plants.

An important factor in the resistance of the cereals is the development of the root system, the comparative smallness of which in wheat and rye (as compared with barley and oats) is probably the reason why they suffer more from foot rot. Moreover, as Merkenschlager and Klinkowski have pointed out [ibid., viii, p. 304], wheat, rye, and barley are much more liable to suffer from excessive humidity during the early stages of growth than are oats which, as hygrophytes, appear to be immune from foot rot. The roots of oats, and to some extent those of barley, are capable of assimilating sufficient quantities of nutrient material under conditions in which the root system of wheat and rye cannot meet the demands made upon it.

Among the measures recommended for the control of foot rot the following may be mentioned: judicious crop rotation based on the facts recorded above; liberal applications of phosphoric acid and (on light soils) potash, combined with sparing use of nitrogenous fertilizers; choice of wheat varieties with a relatively well-developed root system; the latter should be further promoted by various cultural methods which are briefly indicated.

BAYLES (B. B.) & COFFMAN (F. A.). **Effects of dehulling seed and of date of seeding on germination and smut infection in Oats.**—*Journ. Amer. Soc. Agron.*, xxi, 1, pp. 41–51, 1 graph, 1929.

At Moro, Oregon, in 1926, dehulling reduced the germination of oat seed-grain inoculated with smut (*Ustilago levis*) by 10·6 per cent., the corresponding figure for uninoculated grain being 5·8 per cent. [*R.A.M.*, vi, p. 411]. When the grain was dehulled but not inoculated, 6·3 per cent. of the plants failed to reach maturity, compared with 11·1 per cent. when the grain was inoculated. In 1925 dehulling increased the average smut infection in 47 hybrid strains of Markton × Scottish Chief from 5·4 to 17·1 per cent. The corresponding figures in 1926 for the susceptible Early Champion and Sixty Day varieties were 85·4 per cent. smut in dehulled, and 45·6 for hulled, seed-grain. The percentage of infection was much higher among plants from seed sown on dates when the mean temperatures were high than when they were lower.

KURIBAYASHI (K.). **The ascigerous stage of Helminthosporium sativum.**—*Trans. Sapporo Nat. Hist. Soc.*, x, 2, pp. 138–145, 162, 1 pl., 1929. [Japanese, with English résumé.]

In the summer of 1927, wheat and barley leaves infected by *Helminthosporium sativum* [*R.A.M.*, vii, p. 312 *et passim*] were collected at the Sapporo University experimental farm, and cultures of the causal organism were obtained on rice culm decoction agar. Small, blackish, sclerotium-like bodies, in addition to the conidial fructifications of *H. sativum*, were invariably formed on all sides of the fragments of the host tissue placed on the medium, and four to five weeks later these organs developed into perfectly matured perithecia showing the characters of the genus *Ophiobolus.*

In a monospore culture from the filamentous ascospores in the perithecia, conidia identical with those of *H. sativum* were produced in large numbers on various media. Inoculation experiments with the conidia on barley and wheat gave positive results, the characteristic lesions developing on the leaves and bases of the hosts.

As the ascigerous stage of *H. sativum* does not yet appear to have been described, the name of *O. sativus* (P.K. et B.) Ito et Kuribayashi is proposed, with a diagnosis in English. It consists of erumpent, black-walled, pseudoparenchymatous, globose or subglobose perithecia, 370 to 530 by 340 to 470 μ in diameter, with well-developed, subconical or cylindrical ostiolar beaks, measuring 80 to 110 μ in width by 90 to 150 μ in height; numerous hyaline, thin-walled, cylindrical or long-fusiform, straight or curved, slightly stipitate asci with round apices, measuring 110 to 220 by 32 to 45 μ and containing 1 to 8 (mostly 4 or 8) flagelliform or filiform, pale olive-green, 6- to 13-septate ascospores, coiled in a close helix and measuring 160 to 360 by 6 to 9 μ.

The fungus under discussion is readily distinguishable from the three graminicolous species of *Ophiobolus* already described with *Helminthosporium* conidia, viz., *O. heterostrophus*, *O. miyabeanus*,

and *O. kusanoi* [ibid., vii, p. 519] by all the dimensions of its ascigerous stage as well as by its conidial differences.

MATSUMOTO (T.). **On the sclerotial disease accompanying the so-called winter injury of Barley.**—*Journ. Plant Protect.*, xv, 6 pp., 1928. (Japanese.) [Abs. in *Japanese Journ. of Botany*, iv, 3, p. (63), 1929.]

A sclerotial fungus has been found associated with the severe winter injury of barley, wheat, and rye occurring almost every year in Japan (chiefly in the north) [cf. *R.A.M.*, vii, p. 28]. The fungus can only be cultured in a refrigerator at 0° C. or below, scarcely any growth being made at 15°. The reddish-brown, waxy sclerotia are spherical or elliptical, 0·7 to 2 mm. in diameter, and produce white hyphae on germination after several months. A comparison of the Japanese material with many European exsiccata of *Typhula graminum* (of which none of the specimens examined bore spores) and *Sclerotium fulvum* confirmed the author's opinion that these fungi are identical. In the absence of spores it is considered wiser to retain the name of *S. fulvum* for the Japanese fungus pending further investigations.

Die Ursache der Giftigkeit der amerikanischen Gerste. [The cause of the toxicity of American Barley.]—*Mitt. Gesellsch. Vorratsschutz*, iv, 6, pp. 66–67, 1928.

Repeated cases of poisoning of pigs fed on barley imported from North America [*R.A.M.*, viii, p. 98 and next abstracts] have led the German Ministry of Food Stuffs and Agriculture to issue a notification that, from 1st October, 1928, barley coming from the United States (with the exception of Kansas, Oklahoma, Texas, and Colorado) shall only be admitted to the country after a previous test of its innocuity. The symptoms of poisoning in pigs are stated to consist in distaste for food and severe vomiting which, in the case of weakly animals, may lead to death. Examination by Wollenweber of samples of deleterious barley showed the presence in it of *Gibberella saubinetii*, a fungus closely related to the organism that causes 'intoxicating bread' in Russia [ibid., v, p. 543] and Sweden, and to the species of *Fusarium* which attacks the flowers of *Lolium perenne*, the hay from which provokes nervous troubles in cattle fed on it. On the other hand, the investigation of similar samples by the Director of the German Institute of Milling failed to reveal any fungus or toxamine, but showed the presence of undetermined bacteria which fermented barley dough with a copious production of gas and caused a repulsive, butyric acid-like smell. It is believed that these bacteria cause fermentation and the decomposition of proteids in the animal stomach, the products of which are toxic to pigs, animals which are known to be highly susceptible to this kind of poisoning.

In German commercial circles it is stated that the American barley may be rendered innocuous by prolonged storage in the open air (not in bags) and repeated shovelling over so as to secure thorough aeration.

OPPERMANN & DOENECKE. **Fütterungsversuche mit amerikanischer 'Giftgerste'.** [Feeding experiments with American 'poisoned Barley.']—*Deutsche tierärztl. Wochenschr.*, xxxvii, 11, pp. 165–167, 1929.

Twenty-five out of 45 samples of American barley submitted to the writers for examination were held to be suspect on the basis of feeding experiments on swine. Subsequent investigations showed that the grain was infected by *Gibberella saubinetii* [see preceding abstract]. According to the *Oldenburgischer Landwirtschaftsbl.*, 49, 29th November, 1928, Prof. Dickson of Wisconsin University attributes the condition to the excessively severe epidemic of scab caused by this fungus which ravaged the current year's barley crops (especially those following maize) in Ohio, Illinois, Iowa, Indiana, and southern Wisconsin. Various means of eliminating the toxic element and rendering the diseased grain palatable are briefly discussed.

MIESSNER (H.) & SCHOOP (G.). **Über den Pilzbefall amerikanischer 'Giftgerste'.** [On the fungous infection of American 'poisoned Barley'.]—*Deutsche tierärztl. Wochenschr.*, xxxvii, 11, pp. 167–170, 3 figs., 1929.

The 14 samples of American barley examined by the writers yielded cultures of *Gibberella saubinetii* (*Fusarium roseum*), a pink yeast, *Cladosporium herbarum*, and species of *Alternaria*, in the order named. In feeding experiments on swine only the first-named organism proved actually toxic [see preceding abstracts], though some reluctance to consume the *Alternaria*-infected grain was observed. The symptoms induced by the consumption of pure cultures of *G. saubinetii* closely resembled those following the use of infected American barley.

DANCKWORTT (P. W.). **Chemische Untersuchung der amerikanischen Giftgerste.** [Chemical analysis of the American poisoned Barley.]—*Deutsche tierärztl. Wochenschr.*, xxxvii, 11, pp. 170–171, 1929.

The analysis of a number of samples of suspected American barley [see preceding abstracts] gave negative results in respect of the presence of hydrocyanic acid and alkaloids, while the amounts of ammonia, sulphuretted hydrogen, and amines were only slightly higher than in normal lots. Exposed to ultra-violet rays, some of the barley showed a green coloration, especially at the tips of the seeds, but a pure culture of *Gibberella saubinetii* gave no sign of fluorescence.

ELLIOTT (CHARLOTTE) & SMITH (E. F.). **A bacterial stripe disease of Sorghum.**—*Journ. Agric. Res.*, xxxviii, 1, pp. 1–22, 9 pl. [2 col.], 1929.

This is a detailed account of the recent work done in the investigation of the leaf stripe disease of grain and fodder varieties of sorghum and broom corn (*Holcus* [*Andropogon*] *sorghum*) caused by *Bacterium andropogoni*, which was first described in 1905 by E. F. Smith and Miss Hedges from the District of Columbia. Affected leaves bear elongated, red, brown, or purple streaks, from

a few millimetres to many centimetres in length, and either narrow and bounded by veins or coalescing over a large part of the leaf surface; these streaks may also extend to the sheaths and stems. The under side of the lesion bears red crusts of bacterial exudate which are readily soluble in rain water; these may be absent from old lesions.

The causal organism, the pathogenicity of which to all varieties of sorghum was proved experimentally, is a short rod with rounded ends, occurring singly or in pairs, Gram-negative, not acid fast, and staining readily with gentian violet and carbol fuchsin. On beef-peptone agar it varies from 1·3 to 2·5 μ in length by 0·4 to 0·8 μ in width and is motile, with one to several bipolar flagella. It does not form spores, but capsules are produced. The optimum temperature for growth in beef-peptone bouillon is between 22° and 30° C., with a maximum between 37° and 38° and thermal death point at 48°. The optimum reaction for growth is P_H 6·6 to 6·0. The cultural characters of the organism are described at length.

Inoculation experiments on sorghum, and field observations, indicated the existence of varietal differences in susceptibility to the disease. Infections were also experimentally obtained on maize and sugar-cane. It is believed that the spread and dissemination of the disease in nature occurs through the agency of water and air currents, and also of insects, and that probably it is carried over on the seed from season to season, as it may develop in fields not previously sown to sorghum; attempts, however, to isolate the organism from red spots on the seed have so far failed.

The paper terminates with a detailed comparison of this disease with other similar bacterial diseases of sorghum and maize.

HIURA (M.). **Studies on some downy mildews of agricultural plants. I. On Sclerospora graminicola (Sacc.) Schroet., the causal fungus of the downy mildew of the Italian Millet (the first preliminary note).**—*Trans. Sapporo Nat. Hist. Soc.*, x, 2, pp. 146–156, 1929. [Japanese, with English summary.]

This is a report of field observations on the conidial stage of *Sclerospora graminicola* on Italian millet (*Setaria italica*), together with notes on the viability and mode of germination of the conidia [cf. *R.A.M.*, vii, p. 712; viii, p. 99].

Conidia are produced at all stages in the development of the plant. At first their presence is not easily recognized since only the lower leaf surfaces of the seedlings show small, indistinct, white patches of conidia and conidiophores. In a few days the affected leaves begin to lose colour, and then shrivel and die off. After the first attack on young seedlings the remaining leaves are successively infected by the hyphae extending through the tissues. Conidia and conidiophores are produced night after night on the mature leaves for three weeks or more.

Under field conditions the conidia lose their viability as soon as the dew dries off the leaves. When collected before sunrise and brought to the laboratory, where a temperature of 24° C. and 75 per cent. humidity were maintained, the conidia mostly lost their

viability after 20 minutes, whereas under moister conditions they remained viable much longer.

The conidia appeared generally to germinate by the liberation of zoospores, though a few sent out germ-tubes at high temperatures or under conditions of protracted humidity. The former mode of germination, however, is considered to be the typical one, the number of conidia germinating by means of germ-tubes being negligible from the taxonomic standpoint.

CHEEMA (G. S.) & BHAT (S. S.). **The die-back disease of Citrus trees and its relation to the soils of Western India (with examples of successful preventive and remedial treatment). Part I.**—*Bombay Dept. of Agric. Bull.* 55 of 1928, 48+iv pp., 11 figs., 14 diags., 6 graphs, 1929.

This comprehensive account of the causes and control of die-back of citrus trees in western India [*R.A.M.*, vii, p. 316] contains the following items of interest in addition to information already noticed from other sources. Considerable differences in susceptibility to die-back have been observed among the various types of citrus, even when all are raised on the same stock, viz., *Citrus medica* var. *limonum.* The most susceptible varieties are the Santra (loose-skinned) and Mosambi (tight-skinned) oranges (*C. aurantium*), while *C. medica*, with its varieties *limonum* (Jamburi and Id) and *acida* (Kagdi), and *C. decumana* (pomelo) are definitely resistant. The disease is most prevalent in hard, waterlogged, badly aerated, and poorly nourished soils containing an excess of lime, but neither soil conditions nor poor root development account for all the cases observed.

TUCKER (C. M.). **Enfermedades del Café en América.** [Coffee diseases in America.]—*Rev. Agric. Puerto Rico*, xxii, 7, pp. 27–31, 1929.

Notes are given in popular terms on the more important fungous diseases of coffee in Porto Rico and Central and South America. Black root rot (generally attributed to *Rosellinia bunodes*) [*R.A.M.*, vi, p. 601] causes much damage in good soils containing abundant organic matter and well supplied with moisture, while trees growing in poor, shallow, or marshy soils are little affected. The fungus is believed to occur in the virgin forests of Porto Rico and has also been reported from other parts of Central and South America and the West Indies. It is frequently introduced into new plantations on seedlings from infected soil. Other hosts of *R. bunodes* in Porto Rico are *Petiveria alliacea* and *Inga laurina.* Control measures should be based on the isolation of diseased trees by means of trenches, and on the avoidance of conditions favouring the spread of the fungus.

White root rot, caused by an undetermined fungus [loc. cit.], produces similar symptoms to those caused by *R. bunodes*, except that the affected roots are white instead of black. This disease is only known to occur in Costa Rica and Porto Rico.

Omphalia flavida [ibid., viii, p. 378] is stated to be widespread and serious in the coffee-growing countries of Central and South America, and in some of the West Indian Islands. The most

susceptible coffee varieties in Porto Rico are *Coffea arabica* and *C. arabica columnaris*; *C. liberica* and *C. abeokuta* are highly resistant; and *C. laurentii* and *C. canephora* intermediate. Other hosts of the fungus include *Bryophyllum*, *Andira inermis*, orange, mango, ferns, *Commelina* sp., and *I. laurina*. *O. flavida* spreads slowly, and may be controlled by cultural measures, including the cutting down of old trees to a height of six inches from the ground, so that new stems may be produced on the old stocks.

Corticium koleroga also affects chiefly *Coffea arabica* and *C. arabica columnaris* in Porto Rico, where its other hosts include orange, lemon, *Gliricidia*, *Hibiscus*, and *Croton*. In India the disease caused by this fungus is amenable to treatment with Bordeaux mixture [ibid., vii, p. 317], but it is considered doubtful whether this costly method of control is desirable in South America, where the frequent torrential rains would necessitate constant applications of the fungicide. The losses due to *C. koleroga* may be minimized by a reduction of shading in the plantations.

Coffee berry spot (mainly due to *Cercospora coffeicola* but attributed in Mexico to a distinct species, *C. herrerana* Farn.) is most prevalent in scantily shaded plantations in Central and South America, possibly owing to the premature ripening of the fruit under these conditions.

Sclerosis (*Sclerotium coffeicolum*) attacks Liberian coffee in Surinam and British Guiana [ibid., vi, pp. 57, 161].

PAILLOT (A.). **Pathogénie de la muscardine du ver à soie.** [Pathogeny of the muscardine of the silkworm.]—*Comptes rendus Soc. de Biol.*, c, 5, pp. 353–354, 1929.

Details are given concerning the mode of infection of silkworms by *Beauveria bassiana* [*R.A.M.*, vi, p. 610]. The fungus dissolves a passage through the chitin and reaches the blood stream, in which the subsequent development takes place. The examination of blood smears at intervals after infection shows the presence of an increasing number of free branched hyphae. When the mycelium becomes very dense in the blood, the body of the insect assumes a characteristic pasty consistency. The fungus does not penetrate the tissues until the moment of death, and the formation of sclerotia in the organs is a post-mortem phenomenon.

OEHL. **Lymphangitis epizootica beim Schwein. Ein Beitrag zur Kasuistik.** [Epizootic lymphangitis among swine. A contribution to its etiology.]—*Deutsche tierärztl. Wochenschr.*, xxxvii, 3, pp. 39–40, 1929.

Clinical details are given of a fatal case of epizootic lymphangitis in a one-year-old boar. *Cryptococcus farcinimosus* [*R.A.M.*, viii, p. 309] was isolated from the diseased lymph glands. This is believed to be the first record of the occurrence of epizootic lymphangitis in swine. Attempts to trace the source of infection proved fruitless.

HALM (F. V. v.) & JUNKER (H.). **Colloid biological studies on thrush.**—*Jahrb. für Kinderheilkunde*, cxxi, pp. 85–100, 1928. [Abs. in *Chem. Abstracts*, xxiii, 8, p. 1026, 1929.]

The fungus causing thrush in infants [*Candida albicans*: *R.A.M.*, viii, p. 37] is a pleomorphic organism, sometimes forming small yeast-like buds and in other cases producing larger hyphae. The writers studied the effects of numerous chemicals on the type of growth in culture media. Substances causing a depression of the surface tension favour mycelial growth. This may be due to a modification of the cell membrane rendering it more permeable to colloids and thus favouring metabolism. This 'vitaminoid' effect recalls the observation that, in culture media containing water-soluble B, the depression of the surface tension parallels the vitamin content. The question thus arises whether water-soluble B exists, or is merely an expression of surface activity.

HASEGAWA (M.). **Beiträge zur Kenntnis der Oidiomycose der Haut in Japan, insbesondere ihrer kausalen Forschung.** [Contributions to the knowledge of oidiomycosis of the skin in Japan, especially in regard to its etiological investigation.] —*Japanese Journ. of Dermatology*, xxviii, 11, pp. 1104–1124, 7 figs., 1928. [Japanese, with German summary on pp. 86–87.]

Oidiomycosis of the skin is stated to be a comparatively rare condition in Japan. The author gives particulars of a case in which ulcers on the leg of a 67-year-old peasant were found to be due to a variety of *Oidium* [*Candida*] *albicans* [*R.A.M.*, vii, p. 635]. On sugar-containing agar media the fungus forms glistening, disciform, milky-white to brown-tinted colonies composed of spherical, oval, or elongated cells measuring 3 to 6 μ in diameter. The resting cells are fairly large (about 7·5 μ in diameter) and may be readily detected in beerwort agar. Inoculation experiments on mice and guinea-pigs gave positive results.

CASTELLANI (A.). **Certain bronchomycoses which may simulate pulmonary tuberculosis.**—*Journ. Trop. Med. and Hygiene*, xxxii, 1, pp. 1–8; 2, pp. 17–22, 14 figs., 1929.

In this paper the writer discusses the clinical importance of certain bronchomycoses simulating pulmonary tuberculosis, and gives notes on the etiology, pathology, symptomatology, diagnosis, and treatment of these conditions, together with details of illustrative cases.

Bronchomoniliasis is associated with various species of *Monilia* [? *Candida*]. The classification of these species according to their biochemical and cultural characters is explained and supplemented by a table [cf. *R.A.M.*, viii, p. 103]. The so-called 'tea taster's' and 'tea factory' coughs are believed to be bronchomoniliases, Ceylon tea dust having been constantly found to contain species of *Monilia*.

Various other types of bronchomycosis associated with yeast-like organisms and with certain genera of the Fungi Imperfecti, as well as with species of *Mucor*, *Aspergillus*, and *Penicillium*, are also described.

PERUCHENA (J. G.). **Sobre un caso de moniliasis pulmonar.** [On a case of pulmonary moniliasis.]—*Semana Méd.*, xxxvi, 1833, pp. 527–535, 10 figs., 1929.

Full clinical details are given of a case of pulmonary moniliasis in a 45-year-old native of the Argentine. The disease is attributed to a hitherto undescribed species of *Monilia*, with segmented hyphae and cells measuring 8 to 50 by 2 to 15 μ. The systematic position of the fungus, which is named *M. platensis* n. sp., is discussed and notes are given on its biological and other characters. Inoculation experiments on rabbits gave positive results under certain conditions, but guinea-pigs failed to react to any form of inoculation. The cultures lost their virulence in a few days.

ASHFORD (M. B. K.). **La mycologie du canal intestinal à Porto Rico et ses relations avec la sprue tropicale.** [The mycology of the intestinal canal and its relations with tropical sprue.]—*Bull. Soc. Path. Exot.*, xxii, 2, pp. 58–60, 1929.

Of the twelve species of fungi, belonging to four genera, associated with intestinal disease in Porto Rico, three are of special interest, viz., *Monilia psilosis*, *M. parapsilosis*, and *M. krusei* (with which *M. psilosis* may possibly be identical) [*R.A.M.*, viii, p. 103]. Out of 289 cases of sprue examined, 155 (55·3 per cent.) showed the presence of *M. psilosis*; this is considered, however, to be only of secondary importance in the etiology of the disease, in which nutritional disturbances constitute the primary factor [cf. ibid., vii, p. 512].

TATE (P.). **The dermatophytes or ringworm fungi.**—*Biol. Reviews*, iv, 1, pp. 40–75, 5 pl., 1929.

This is a comprehensive survey of the history of the dermatophytes, beginning with the discoveries of Remak and Schönlein in 1837 and 1839, respectively, concerning the parasitic nature of ringworm, and touching on the more important later developments of the subject up to the present day. Observations, based on the author's own studies as well as on a perusal of the relevant literature, are made on the morphology, physiology, cytology, and taxonomy of the dermatophytes, and notes are given on suitable methods for the investigation of these organisms.

GUIART (J.). **A propos des travaux récents sur la classification des dermatophytes.** [Note on the recent studies on the classification of the dermatophytes.]—*Ann. de Parasitol. Humaine et Comp.*, vii, 1, pp. 80–82, 1929.

In this brief note [written on somewhat polemical lines] the author, replying to Langeron's and Sabouraud's criticisms [*R.A.M.*, viii, p. 172] of the classification of the dermatophytes suggested by Grigorakis, expresses his adhesion to the latter's views. Further, he points out that the three classifications proposed by Ota and Langeron, Vuillemin, and Grigorakis are, on the whole, entirely superposable, and only differ in certain details, on which agreement may easily be arrived at.

GRIGORAKIS (L.). **L'étude des dermatophytes et les critiques de MM. Sabouraud et Langeron.** [The study of the dermatophytes and the criticisms advanced by Sabouraud and Langeron.]—*Ann. de Parasitol. Humaine et Comp.*, vii, 1, pp. 83–87, 1929.

In this reply to Sabouraud's and Langeron's criticisms of the classification of the dermatophytes proposed by him [see preceding abstract], the author briefly restates the considerations that led to its adoption. The main source of error in the classifications previously suggested appears to reside in the fact that the investigators did not fully realize the difference between polymorphism and pleomorphism in the fungi considered.

CATANEI (A.). **Les teignes du cuir chevelu chez les indigènes des environs d'Alger.** [Scalp ringworms among the natives of the environs of Algiers.]—*Bull. Soc. Path. Exot.*, xxii, 2, pp. 60–64, 1929.

A systematic examination (the first of its kind) of 770 native children inhabiting the plain of Mitidja (Algiers) showed that 80 (10·4 per cent.) were affected by ringworm of the scalp associated with *Trichophyton glabrum* (in 78·5 per cent. of the cases) and *T. violaceum* [cf. *R.A.M.*, viii, p. 241]. *T. sulfureum* was isolated in one case, this being the first record of its occurrence in Algeria.

URBAIN (A.). **Sur la durée de vitalité et de virulence de Trichophyton gypseum incorporé à des litières.** [On the duration of viability and virulence of *Trichophyton gypseum* incorporated with bedding.]—*Comptes rendus Soc. de Biol.*, xcix, 38, pp. 1917–1919, 1929.

An emulsion of a three-weeks-old culture of *Trichophyton gypseum* was sprinkled over the straw bedding of two cages previously occupied by guinea-pigs for a week. After five months fragments of the material from one of these cages were sown in tubes on Sabouraud's medium and yielded cultures of the fungus in two cases. Inoculation experiments with these cultures on guinea-pigs gave positive results [*R.A.M.*, vii, p. 720]. The bedding in the second cage, examined after nine months, yielded one culture of *T. gypseum* which also produced the typical symptoms of ringworm on guinea-pigs. Four of these animals with recent dorsal abrasions were placed in the second cage and contracted, in 14 to 18 days, lesions from which the fungus was isolated.

KARRENBERG (C. L.). **Primäre Hautaspergillose als Komplikation bei einem an Mikrosporie erkrankten Kinde. (Zugleich Bemerkungen über Vorkommen und Pathogenität der Spezies Aspergillus flavus Brefeld).** [Primary skin aspergillosis as a complication in a child suffering from microsporosis. (Together with observations on the occurrence and pathogenicity of the species *Aspergillus flavus* Brefeld).]—*Dermatol. Wochenschr.*, lxxxviii, 3, pp. 89–95; 4, pp. 125–129, 4 figs., 1929.

A six-year-old boy suffering from ringworm of the scalp due to

Microsporon audouini suddenly developed an unusual type of eruption extending almost round the neck. *Aspergillus flavus* (the taxonomy, morphology, and pathogenicity of which are discussed) was isolated from the greyish-yellow, crusted, inflamed lesions. The fungus was inoculated into the writer's left arm with positive results and retrocultures were obtained.

MATSUURA (I.). **On a new leaf-spot disease of Impatiens balsamina L. caused by Cercospora fukushiana n. sp.**—*Trans. Tottori Soc. Agric. Sci.*, i, pp. 83–88, 2 figs., 1928. (Japanese résumé.) [Abs. in *Japanese Journ. of Botany*, iv, 3, pp. (63)–(64), 1929.]

Impatiens balsamina was observed in several localities of southern Japan to be affected by a leaf spot due to the fungus *Cercospora fukushiana* n. sp. The diseased foliage is marked by light brown, greyish or whitish, circular, oval or rectangular, sharply delimited spots, with brown or reddish-brown margins, measuring 1 to 7 mm. in diameter. The organism was cultivated on a number of nutrient media, numerous hyaline conidia being produced on apricot decoction only. Inoculation experiments gave negative results.

NICOLAS (G.) & AGGÉRY (Mlle). **Sur un Heterosporium parasite de Viburnum odoratissimum.** [On a *Heterosporium* parasitic on *Viburnum odoratissimum.*]—*Comptes rendus Acad. des Sciences*, clxxxviii, 9, pp. 648–650, 1929.

A brief description is given of a fungus which was found in Toulouse in January, 1929, attacking the leaves of *Viburnum odoratissimum*, on which it formed irregular, purplish-red spots, from 1 to 1·5 cm. in diameter. On the under side the spots bore a whitish efflorescence composed of tufts of slightly brownish, nodose, septate, usually branched conidiophores, measuring from 200 to 250 by 4·8 to 5 μ, and arising on small, elongated or spherical, subcuticular stromata. On the upper side of the leaves, the mycelium formed much larger, spherical stromata, from 60 to 105 μ in diameter, which eventually broke through the cuticle and produced numerous, septate, very rarely branched conidiophores, from 60 to 95 μ in length. This dimorphism of the conidiophores is explained by the differences in the structure of the cuticle on the upper and lower sides of the leaves. The conidia produced on both sides are identical: they are light brownish-yellow, oval, occasionally cylindrical, not constricted, covered with minute warts, one- to four-celled (the majority two-celled), and measure 8·3 to 23·5 by 4·8 to 7·2 μ. They germinate either by budding off secondary conidia or by the production of a germ-tube. The authors consider the organism to be a hitherto undescribed species of *Heterosporium*, which they name *H. polymorphum*.

NICOLAS (G.) & AGGÉRY (Mlle). **Un Cycloconium parasite de Phillyrea angustifolia.** [A *Cycloconium* parasite on *Phillyrea angustifolia.*]—*Bull. Soc. Myc. de France*, xliv, 3, pp. 301–303, 1 fig., 1928.

In a leaf disease of *Phillyrea angustifolia* occurring at Toulouse and characterized by the appearance of brown, amphigenous,

sparse or confluent spots, 1 to 4 mm. in diameter, which turned grey and showed a blackish margin as the leaf withered, the authors observed a fungus, the conidiophores of which were arranged in concentric circles and bore one or two elongated, straight or slightly curved, yellowish-green conidia, 1- to 3-, occasionally 4-septate, having a thick, slightly warty wall, and measuring 16 to 34 by 7·5 to 10·5 μ.

In view of these characters the authors consider the fungus to be a new species of the genus *Cycloconium*, which they name *C. phillyreae*. A Latin diagnosis is appended.

KILLIAN (C.). **Un parasite nouveau des feuilles d'Aronia rotundifolia Pers., le Gloeosporium aroniae nov. spec.** [A new parasite of the leaves of *Aronia rotundifolia* Pers., *Gloeosporium aroniae* n. sp.]—*Bull. Soc. Myc. de France*, xliv, 3, pp. 241–248, 2 pl., 1928.

In September, 1927, at Strengenberg (Haut-Rhin), the author noticed a leaf spot of the service berry (*Aronia* [*Amelanchier*] *rotundifolia*) caused by a species of *Gloeosporium* to which the name *G. aroniae* n. sp. is given. The leaves bore black, erumpent, elliptical or angular, amphigenous spots on which acervuli developed, bearing oval, elongated or polygonal, unicellular conidia, 4 to 5 μ in diameter. A pycnidial form of fructification was also noted on the same mycelium as the acervuli, forming small plectenchymatous masses with an outer layer of brown cells and a central, sporogenous, thin-walled tissue from which microconidia, 1 μ in diameter, were liberated through an ostiole in the following spring.

In the author's cultures [which are fully described] the pycnidial form developed readily and on some media a multilocular stroma bearing pycnospores up to 4 μ in diameter was formed. These closely resembled the conidia borne in acervuli. Monilioid aerial hyphae, which disarticulated into spherical elements, appeared in some cultures.

RAMAKRISHNA AYYAR (T. S.). **Pythium aphanidermatum (Eds.) Fitz. on Opuntia dillenii Haw.**—*Mem. Dept. Agric. India*, Bot. Ser., xvi, 7, pp. 191–201, 3 pl., 2 graphs, 1929.

An account is given of a wet rot of the cladodes of *Opuntia dillenii* plants grown in pots [presumably at Coimbatore, south India], which was observed in 1925 and which eventually resulted in the death of the plants. Isolations from the affected tissues yielded *Pythium aphanidermatum*, and inoculation experiments showed the fungus to be capable of infecting and rotting any portion of the plant, and also of causing pathological symptoms on a considerable number of other hosts, belonging to widely separated families. The cultural characters of the organism on various media are described in detail, and it produced sporangia and oospores profusely. Besides the lobulate sporangia, the fungus formed on some media club-shaped or thick and falcate structures which, on account of the fact that when placed in water they produced germ-tubes, are believed to function as conidia.

Comparative studies with *P. aphanidermatum* and *P. butleri*

in pure culture and in inoculation experiments lead the author to agree with the conclusion of Mitra and Subramaniam [*R.A.M.*, vii, p. 488] that the latter is merely a strain of the former, only differing in its degree of parasitism on mature *Carica papaya* trees.

GRAINGER (J.). **An infectious chlorosis of the Dock.**—*Proc. Leeds Phil. Soc.* (*Scient. Sect.*), i, 8, p. 360, 1 pl., 1928. [Received May, 1929.]

A broad-leaved dock (*Rumex obtusifolius*) growing near Leeds was affected, in October, 1927, by a mottle-chlorosis of the younger foliage. Seven healthy docks were inoculated with the sap from this diseased plant in a cool greenhouse, and five developed the symptoms of chlorosis 16 to 21 days later [*R.A.M.*, v, p. 314]. No marked stunting or other deviations from the normal habit of growth were observed in the affected plants. The mottling assumed two apparently distinct forms, occurring in some plants in the intervenal spaces while in others large patches extend over several veinlets. *R. lanceolatus* has also been found showing the above-mentioned symptoms. The disease is widely distributed in the Weetwood district of Leeds, where over 80 per cent. of the docks are attacked.

ENDO (S.). **Studies on Hypochnus centrifugus from Trifolium repens.**—*Journ. Microbiol. and Path. Japan*, xxii, pp. 1851–1866, 2 figs., 1928. (Japanese.) [Abs. in *Japanese Journ. of Botany*, iv, 3, p. (56), 1929.]

Hypochnus centrifugus [*Corticium centrifugum*: *R.A.M.*, viii, p. 263], occurring as a parasite on white clover (*Trifolium repens*) in Japan, was tested for its pathogenicity towards various other plants. It was found to produce slight infection on wounded and unwounded rice (leaf sheaths and ligules), tobacco, cucumber, and watermelon plants, at a temperature of 20° C. and above. At 65° to 66° the sclerotia are killed in four hours, at 90° to 91° in forty minutes, and at 91° to 96° in thirty minutes; death from high temperatures occurs more rapidly under moist than under dry conditions.

FAWCETT (G. L.). **Plaga de los Alfalfares.** [A disease of Lucerne.]—*Rev. Indust. y Agric. de Tucumán*, xix, 7–8, p. 215, 1929.

Reporting on the examination of lucerne plants infected by *Rhizoctonia violacea* [*R. crocorum*: *R.A.M.*, vii, p. 20] in Tucumán, the writer states that the disease may be controlled by one or two years' rotation with maize, Rhodes grass [*Chloris gayana*], or other crops resistant to the attacks of the fungus. The disease seldom occurs in mixed plots of lucerne and Rhodes grass.

CAMPBELL (J. A.). **Control of fireblight in the orchard. Hints to fruitgrowers.**—*New Zealand Journ. of Agric.*, xxxviii, 1, pp. 35–36, 1929.

After referring to recent legislation for the control of fireblight [*Bacillus amylovorus*: cf. *R.A.M.*, vii, pp. 208, 416] in New Zealand,

and pointing out that success largely depends upon the efforts of the growers, the author states that the fireblight season begins at the blossoming period, and any hold-over cankers then found should be regarded as of the previous season. Later, the disease is largely insect-borne, though new infections are mainly confined to trees in the vicinity of those originally affected. The discovery by official inspection of hold-over cankers after 31st July will involve prosecution. The full inspection service is limited to those districts where the hawthorn [*Crataegus*] hedges have been satisfactorily disposed of; where no commercial fruit-growing area has been officially declared under the fireblight regulations [ibid., ii, p. 144], the condition will be dealt with as an ordinary orchard disease.

ADAMSON (N. J.). **The fireblight menace. Severe experience in a Hawke's Bay orchard.**—*New Zealand Journ. of Agric.*, xxxviii, 2, pp. 108–111, 3 figs., 1929.

A detailed description is given of a severe outbreak of fireblight [*Bacillus amylovorus*: *R.A.M.*, viii, p. 315, and preceding abstract] of apple and pear trees in an orchard at Hawke's Bay, as an illustration of the real menace to the fruit-growing industry in New Zealand that is presented by the occurrence of the disease in the Dominion. During a survey of the orchard made in the 1927–8 season a number of infection foci were discovered on the trees, most of which were removed by pruning. Those that were overlooked, however, continued to develop and produced the characteristic bacterial ooze at a period coinciding with blossoming in the 1928–9 season, and wholesale infection occurred throughout the orchard. As a result, the apple crop on most of the varieties grown was practically wiped out, Sturmer and Ballarat suffering almost complete loss. The damage done is further aggravated by the fact that next year a crop of only about half the normal can be expected, owing to the considerable killing of fruit buds and spurs, although no other severe damage was done to the trees, as the disease did not pass over into the bigger limbs.

On pear trees the bud infections were less numerous than on the apples, but the disease made such rapid progress that before the pruning out of the infected twigs could be started in earnest, large fruiting arms and whole limbs were involved and had to be removed, and before this work could be completed several trees became so diseased as to require immediate destruction.

The author states from his own experience that it is possible to suppress fireblight even in fairly large orchards within a year by sufficiently drastic pruning of all existing lesions, but only if there are no hawthorn hedges or bushes in the neighbourhood; if these are present, the chances of getting rid of the disease are very small indeed.

DUTTON (W. C.). **A method of modifying the lime-sulphur-lead arsenate spray to reduce foliage injury in the Apple.**—*Proc. Amer. Soc. Hort. Sci.*, *1928*, pp. 332–333, 1929.

During the past four seasons the various forms of foliage injury consequent on the use of the standard lime-sulphur-lead arsenate spray for the control of apple scab [*Venturia inaequalis*] in

Michigan [*R.A.M.*, viii, p. 45] have been greatly reduced by the addition to the mixture of a small quantity of ferrous sulphate ($\frac{1}{2}$ to $3\frac{1}{2}$ lb. per gall., the former amount probably representing the optimum). The use of this preparation in the late summer is undesirable owing to its tendency to stain the fruit, and it should therefore be replaced by 2–2–100 Bordeaux mixture for the final spray.

Plagge (H. H.). **Effect of storage temperature on soggy breakdown of Golden Delicious Apples.**—*Proc. Amer. Soc. Hort. Sci., 1928*, pp. 298–300, 1929.

The results of two years' experiments [which are briefly described] in the relation of varying storage temperatures to soggy breakdown in Golden Delicious apples [*R.A.M.*, vii, p. 790] showed conclusively that, when storage is delayed, detrimental effects occur between 30° and 34° F. With immediate storage no soggy breakdown was observed at any of the temperatures, but with 7 days' delay it developed at 30°, and with 14 and 21 at 30°, 32°, and 34°. The condition did not occur at 36° or in the common storage room, where the temperature was never below 35°. The susceptibility of this variety to soggy breakdown increased almost uniformly in proportion to the lowering of the storage temperature, and also to the protraction of the period between picking and storage.

McClintock (J. A.). **Importance of leafspot in the selection of Pear varieties used as stocks for budding.**—*Proc. Amer. Soc. Hort. Sci., 1928*, p. 177, 1929.

Attention is drawn to the fact that the fireblight [*Bacillus amylovorus*]-resistant pears, *Pyrus serotina* and *P. ussuriensis*, are very liable to infection by leaf spot (*Fabraea maculata*) under Tennessee conditions. On the other hand *P. calleryana* and *P. betulaefolia* (especially the former) show a marked degree of resistance to both leaf spot and fireblight [cf. *R.A.M.*, vi, p. 624]. The budding tests have shown that *P. serotina* and *P. ussuriensis* are as rapidly defoliated when grown directly from seed as when stock is imported from western nurseries, indicating that the leaf spot fungus is indigenous in the south. So heavy is the infection by *F. maculata* on these varieties that defoliation is almost complete by midsummer, when dormant budding is usually done.

Duruz (W. P.). **Further notes regarding Peach rust control.**—*Proc. Amer. Soc. Hort. Sci., 1928*, pp. 333–337, 1929.

Further investigations were conducted at Davis, California, on the mode of infection and control of peach rust (*Tranzschelia punctata*) [*Puccinia pruni-spinosae*: *R.A.M.*, vii, p. 590; viii, p. 319]. Field studies indicated that the bark pustules observed on twigs early in January are initiated by infection occurring in the previous autumn. This is regarded as of considerable importance as emphasizing the urgency of early autumn spraying to prevent infection of the current season's wood growth. Leaf infection in unsprayed trees developed from April to early June. An examination of the rainfall data for the period 1926 to 1928, inclusive, showed that rain is essential to the continued development

of the summer stage of peach rust. The best control was given by liquid lime-sulphur (full dormant strength); Bordeaux mixture was also satisfactory in the early autumn but less so in the late autumn and spring. The results of the spraying tests are tabulated.

TOGASHI (K.). **On the development of two races of Valsa in relation to the hydrogen-ion concentration of Peach trees.**—*Agric. & Hort.*, iii, pp. 893–902, 2 figs., 1928. (Japanese.) [Abs. in *Japanese Journ. of Botany*, iv, 3, p. (76), 1929.]

A study has been made of two strains (A and B) of *Valsa* [? *leucostoma*], the causal organism of canker or die-back of peach trees. The expressed juice of healthy trees indicates a hydrogen-ion concentration $P_H \pm 5{\cdot}0$, the corresponding figures for the cortex, medullary rays, cambium, and bast being 4·4 to 5·6, 4·4 to 5·0, 4·4 to 4·6, and 5·0 to 5·8, respectively. Both strains of the fungus were found to develop best in slightly acid media (A at $P_H \pm 5{\cdot}5$, B at $\pm 6{\cdot}0$), the reaction being modified first in the direction of acidity and then back towards alkalinity. The hydrogen-ion concentration of diseased peach tissues was found to be higher than that of normal ones (P_H 4·4 to 4·6 or even 3·6 to 3·8).

RIVES (L.). **Sur les causes de dépérissement de l'Abricotier par apoplexie.** [On the causes of the dying-off of the Apricot from apoplexy.]—*Rev. de Vitic.*, lxx, 1805, pp. 73–76, 1929.

This is a condensed version of a paper by the same author dealing with the wilt of apricots associated with a bacillus and a coccus in the Rhone valley which has already been noticed from another source [*R.A.M.*, viii, p. 388].

CROWLEY (D. J.). **Cranberry growing in Washington.**—*Washington Agric. Exper. Stat. Bull.* 230, 47 pp., 13 figs., 1929.

This bulletin contains (pp. 37–41) some observations of the fungous diseases of cranberries [*Vaccinium macrocarpon*] and their control in Washington [*R.A.M.*, viii, p. 114]. A summary of the fungi isolated from Washington cranberries of the Batchelder, Centennial, Early Black, Howe, McFarlin, and Pacific Beauty varieties during 1922–3 and 1923–4 is presented in tabular form. From this it appears that end rot (*Fusicoccum putrefaciens*) is normally responsible for one-third to one-half of all storage losses, with *Phomopsis* and *Sporonema* spp. [ibid., iii, p. 281; vi, p. 304] next in importance. The amount of damage caused by black rot (*Ceuthospora lunata*) varies greatly, being considerable in some seasons and relatively slight in others. *Botrytis* spp. cause heavy losses when the berries are picked wet, as during the rainy harvest of 1927.

The results of spraying experiments in progress since 1922 are tabulated and briefly described. The first application was given as soon as growth started; the second when the blossoms were in the 'hook' stage or just before opening; the third when about half the blossoms had fallen; the fourth ten days later, when the berries were about the size of peas; and the fifth two weeks later. Bordeaux mixture 4–4–50 plus 1 lb. soap was used in all the sprays

except the fifth, when a Burgundy mixture was given. In the seasons when the keeping quality of the berries was poor, nearly 50 per cent. shrinkage was found in unsprayed fruit in commercial storage, while the losses in the treated lots were under 8 per cent. All the work to date indicates that the second and third Bordeaux sprays are of primary importance in the control of storage rots, especially during unfavourable seasons.

HARA (K.). **On Cercospora kakivora.**—*Journ. Agric. Soc. Shizuoka Prefecture,* xxxiii, 375, pp. (1)-(6), 1 col. pl., 6 figs., 1929. [Japanese.]

In October, 1927, the writer found a new species of *Cercospora* attacking living leaves of persimmon (*Diospyros kaki*) in the Shizuoka Prefecture, Japan. The fungus, which is named *C. kakivora*, is characterized by an amphigenous, immersed, spherical, membranaceous, dark brown stroma, 30 to 80 μ in diameter; dark brown, filiform, straight or curved, caespitose, simple or branching conidiophores with 2 to 7 septa, measuring 55 to 104 by 4·4 to 6 μ; and dark brown, vermiform or obclavate, 9- to 17-septate conidia, measuring 100 to 170 by 5 to 6 μ. The spots formed on the persimmon leaves are irregularly polygonal or circular, light or dark brown to persimmon-coloured, 3 to 10 mm. in width, with well-defined, reddish-brown margins. A new species of *Botrytis*, to which the name *B. cercosporaecola* is given, was found parasitizing *C. kakivora*. It is characterized by slender, septate, hyaline, filiform hyphae, 1 to 2 μ in width; hyaline, conical or filiform conidiophores, 13 to 17 by 4 to 5 μ; and spherical, ovate, or elliptical spores, measuring 4·4 to 8·8 by 3 to 4·4 μ.

HENGL (F.). **Zur Anwendung des Solbars.** [On the application of solbar.]—*Allg. Weinzeit.*, xlvi, 3, pp. 34–35, 1929.

The disappointing results sometimes obtained with solbar as a substitute for Bordeaux mixture are attributed largely to incorrect methods of preparation. In order to produce the most satisfactory 3 per cent. solution, 3 kg. of solbar should first be made into a thin paste by the addition of 3 l. of water; the remaining 97 l. should then be added and the mixture repeatedly stirred for half an hour. When the solbar is poured straight into the whole of the water, a considerable proportion remains on the surface and is not dissolved.

GOODWIN (W.), SALMON (E. S.), & WARE (W. M.). **The action of certain chemical substances on the zoospores of Pseudoperonospora humuli (Miy. et Takah.) Wils.**—*Journ. Agric. Sci.*, xix, 1, pp. 185–200, 1929.

Full details are given of a series of experiments which were made during the summer of 1928 on living leaves of hop plants sprayed with zoospore suspensions and also under laboratory conditions to test the fungicidal action of weak solutions of soft soap or saponin on the zoospores of the downy mildew of hops (*Pseudoperonospora humuli*). It was found that solutions stronger than 0·2 per cent. are completely effective in immediately stopping the movement of actively motile zoospores, which disintegrated either

instantly or in a few seconds. At the lowest dilution tested (0·005 per cent.), the disintegration of the zoospores began in 6 minutes and was complete at the end of two hours. This action of the solution on the zoospores is believed to be due to changes in surface tension. Comparable results were also obtained with *Phytophthora infestans* in the zoospore stage.

Further experiments were then made to test the action, on hop plants exposed to infection, of soap and saponin solutions mixed with certain more strongly adherent substances. A solution containing 0·5 per cent. soap and 0·5 per cent. colloidal sulphur (a substance which, by itself, was found to have no marked action on the zoospores) afforded good protection and did not cause any injury to the plants. Lime casein, gelatine, and flour paste alone proved inefficient in destroying the zoospores. Other substances tested included lime-sulphur, Bordeaux mixture, and sodium polysulphide. Bordeaux mixture and lime-sulphur solutions with soap caused some injury to the leaves, as did also a mixture of glue, sodium polysulphide, and soap. In the laboratory the power of adhesion and the fungicidal efficacy of the mixtures were tested by allowing single drops to dry on the surface of watch glasses and by then adding drops of water containing the zoospores.

The zoospores of both *P. humuli* and *P. infestans* were found to be killed instantly by some other chemical substances, e. g., aluminium-lime mixture (0·25 gm. each hydrated lime and aluminium sulphate in 100 c.c. water), glycerine, iodine, and bromine.

PORTER (R. H.). **Some aspects of plant pathology in China.**—*Proc. Third Pan-Pacific Sci. Congr.*, Tokyo, *1926*, ii, pp. 2091–2097, 1928. [Received May, 1929.]

The estimated reduction of the eastern and northern Chinese wheat crop from parasitic diseases was 20 per cent. in 1925, and unpublished data place the corresponding loss for 1926 at 21 per cent. [cf. *R.A.M.*, v, p. 656]. The 1925 losses in the barley, maize, kaoliang [sorghum], and millet [*Setaria italica*] crops were estimated at 13, 17, 20, and 20 per cent., respectively, the corresponding figures for 1926 being 25, 14, 16, and 18 per cent.; in the latter year the reduction in the staple broad bean (*Vicia faba*) crop was calculated at 29 per cent. Promising results have already been obtained by seed disinfection with dusts for the control of covered smut of barley (*Ustilago hordei*) and millet smut (*U. crameri*: ibid., viii, p. 234], and it is considered essential that western methods of treatment should also be applied to fruit and vegetable diseases. One of the most promising lines of research in China is that relating to the development of disease-resistant plants. Thus the writer is at present engaged on a study of the reaction of over 600 wheat varieties to flag smut (*Urocystis tritici*). Another essential subject of investigation is the occurrence of diseases which are serious in China but have hitherto escaped attention elsewhere owing to their slight importance. In conclusion, attention is drawn to the urgent need for the development of plant pathology in China and to the difficulties attending the provision of proper facilities for research and experimentation under the present unsettled political conditions.

MORSTATT (H.). **Die jährlichen Ernteverluste durch Pflanzenkrankheiten und Schädlinge und ihre statistische Ermittelung.**] [The annual reductions of yield through plant diseases and pests and their statistical estimation.]—*Ber. über Landw.*, N.F., ix, 4, pp. 433–477, 1 map, 1929.

This is the full account of the writer's examination of the statistical data available for the evaluation of the losses caused by plant diseases and pests in Germany, a few figures from which have already been given [*R.A.M.*, vii, p. 796]. Numerous data are cited from various German and other publications dealing with crop losses, and the paper concludes with a survey of the existing methods of securing information on this point in Germany, the United States, and elsewhere [cf. ibid., vii, p. 189].

RAYNER (Miss M. C.). **The biology of fungus infection in the genus Vaccinium.**—*Ann. of Botany*, xliii, 169, pp. 55–70, 1 pl., 1929.

Full particulars are given of the writer's extensive studies, begun in 1915, on the conditions governing infection by endophytic fungi in cranberries (*Vaccinium oxycoccus* and *V. macrocarpon*) [*R.A.M.*, iv, p. 366].

The fine mycelium of the endophytic fungi of these plants was definitely detected throughout the shoot tissues extending to the ovaries and other organs of the flower, and also in the tissues of the fruit, seed-coat, endosperm, and seedling shoot. In *V. macrocarpon* mycelium is present in the young fruit-chambers in July, and has extended to the endosperm of the seeds by the middle of August, at a stage of development just coincident with the completion of wall formation. Infestation of the seed is more extensive in *Vaccinium* than in *Calluna*, mycelium being present throughout the tissue of the seed-coat and penetrating deeply within the endosperm of the resting seed. At this stage it has not been observed within the tissue of the embryo.

Owing to the character of seed infection, it is impossible to obtain *Vaccinium* seedlings free from fungus infection, either by means of seed sterilization or by the removal of the seed-coats previous to germination, at which period all the tissues of the emerging seedling are subject to invasion by the mycelium. Although direct proof must inevitably be lacking, it may be inferred that normal seedling development is bound up with such infection, and that under normal conditions an obligate relation exists similar to that demonstrated in *Calluna* [ibid., ii, p. 326].

Fungus invasion of the seedling tissues at germination, and mycorrhiza formation, are two distinct phenomena both in *Vaccinium* and *Calluna*, the former taking place regularly at an early stage of development, while the latter is an annual process largely influenced by soil conditions.

Ovarial infection by mycelium has also been detected in several other species of *Vaccinium*, including *V. myrtillus*. It is impossible, therefore, to raise seedlings of this species entirely free from fungus infection by sowing seeds in sterilized soil as claimed by Stahl (*Jahrb. Wissench. Bot.*, xxxiv, p. 539, 1900).

STEINMANN (A.). **Over het optreden van mycorrhiza bij Kina op Java.** [On the occurrence of mycorrhiza on *Cinchona* in Java.] —Reprinted from *Cinchona*, v, 1–2, 7 pp., 2 pl., 1928. [Received May, 1929.]

The mycorrhizal fungus found in the smaller roots and hair roots of *Cinchona* in Java is characterized by the presence, in the outer cell layers of the cortex, of brown to nearly black (occasionally hyaline), inter- and intracellular, branched hyphae, 1·7 to 3·5 μ thick, often having swollen cells and sometimes forming clumps resembling the 'sporangioles' described by Janse (*Ann. Jard. Bot. Buitenzorg*, xiv, p. 53, 1897). The root cells of *C. succirubra* further contain dark grey to greyish-brown pseudoparenchymatous tissue strongly suggestive of sclerotia; similar bodies have been found in the roots of *Thea japonica* in the mountain plantations of Tjibodas, where an endophyte also occurs in cultivated tea. All attempts to obtain cultures of the fungus gave negative results.

An apparently identical organism has been found in the roots of *Vaccinium varingiifolium* in the volcanic region of the Gedeh.

PIESCHEL (E.). **Über Pilze als Erlenbegleiter und über die Mykorrhizenfrage bei Erlen.** [On fungi as companions of Alder and on the mycorrhiza problem in Alders.]—*Zeitschr. für Pilzkunde*, N.F., viii, 2, pp. 23–28, [1929].

The writer has observed that alders (*Alnus glutinosa*) in various parts of Germany are constantly associated with two species of *Lactarius*, viz., *L. lilacinus* and *L. cyathula*. Although these fungi have not been definitely proved by synthesis to form mycorrhiza, the whole nature of their development suggests that they do so, and in one case the alder roots were found to be covered with a true mycorrhizal network, apart from the well-known root tubercles of this plant.

NICOLAS (G.). **Sur un endophyte de Lunularia cruciata (L.) Dumortier.** [On an endophyte of *Lunularia cruciata* (L.) Dumortier.]—*Comptes rendus Acad. des Sciences*, clxxxviii, 2, pp. 188–189, 1929.

The author states that since 1924 he has every year found the fungus named by Maire *Humaria nicolai* growing in close contact with the thalli of a few liverwort plants (*Lunularia cruciata*) in a courtyard of the Faculté des Sciences in Toulouse, and he believes that the endophytic mycelium which has constantly been found in the thalli is probably that of this species.

CARBONE (D.). **Über die aktive Immunisierung der Pflanzen.** [On the active immunization of plants.]—*Centralbl. für Bakt.*, Ab. 2, lxxvi, 25–26, pp. 428–437, 1929.

Since 1922 the writer and his colleagues at the Serotherapeutical Institute, Milan, have been engaged on a study of the possibilities in connexion with the active immunization of plants by means of inoculation. In this paper a summary is given of the work of pre-

vious investigators on the 'vaccination' of plants against parasitic or symbiotic bacteria and fungi, in which it is claimed that in 18 reported cases full success (at least during a certain period of time) was obtained in 16, while the other two showed some evidence of an immunizing reaction.

Complete immunization was effected in the following cases: *Begonia* sp. with *Botrytis cinerea*; white lupin [*Lupinus albus*], wheat, oats, and beans [*Phaseolus vulgaris*] with *B*[*acillus*] *putrefaciens*; various orchids with *Rhizoctonia*; potato with mycorrhizal fungi of bittersweet [*Solanum dulcamara*]; wheat with *Helminthosporium sativum* [*R.A.M.*, v, p. 246]; Soissons beans with *Botrytis cinerea* [ibid., vii, p. 339]; Wahl beans with *Bacillus carotovorus* [loc. cit.]; wheat, cabbage, cauliflower, and other plants with *Leptosphaeria herpotrichoides, Fusarium vasinfectum, F. oxysporum,* and other fungi [ibid., v, p. 50]; *Loroglossum hircinum* with *R. repens, Orcheomyces* [*R.*] *psychodis, R. chlorantae,* and *R. hircini* [ibid., iv, p. 443; vii, p. 338]; and maize with *Ustilago maydis* [*U. zeae*: ibid., vi, p. 547]. In the case of potato inoculated with a *Bacillus* of the *B. mesentericus* group [ibid., viii, p. 195] and peas with *Blepharospora* [*Phytophthora*] *cambivora* [ibid., viii, p. 117], the beneficial effects of the treatment, though less marked, were yet sufficiently noticeable. The control plants, exposed to infection in the ordinary way, were all attacked by the parasites and mostly killed.

DUFRÉNOY (J.). **Étude cytologique des rapports entre parasite et cellule végétale.** [Cytological study of the relations between parasite and plant cell.]—*Ann. Inst. Pasteur*, xliii, 2, pp. 218–222, 4 figs., 1929.

A study was made of *Arisoema triphyllum*, a common plant among the undergrowth in the woods of New York State, attacked by the rust *Uromyces caladii*. The examination of epidermal fragments immersed in a 10 per cent. solution of neutral red showed that in the infected cells the vacuole shrinks and divides into a number of small vacuoles separated by cytoplasmic trabeculae. This process is specially conspicuous in the region occupied by the tip of the hypha, which may itself be affected by the proteolytic phenomenon to the extent of swelling and becoming vacuolate.

BOTJES (J. O.). **De oorzaak van de beteekenis van onrijp gerooide knollen als pootgoed.** [The cause of the significance of early lifted tubers as seed.]—*Tijdschr. over Plantenziekten*, xxxv, 1, pp. 9–12, 1929.

Further comparative experiments in the use of mature and immature potato tubers for seed have confirmed the writer's previous conclusion [*R.A.M.*, iii, p. 101], that this distinction is of importance only where the crop is exposed to infection by mosaic or leaf roll. The higher yielding capacity of the early lifted tubers is due solely to their timely removal from union with the diseased foliage, and not to any inherent superiority or difference in chemical composition.

Brüne (F.). **Ergebnisse von vergleichenden Kartoffelsortenversuchen auf Hochmoor-, Sand-, und Marschboden im Jahre 1928.** [Results of comparative experiments with Potato varieties on moorland, sand, and fen soils in the year 1928.]—*Mitt. Ver. Förderung der Moorkult. im Deutschen Reiche*, xlvii, 2, pp. 27–32, 1929.

In a series of comparative tests with thirteen different potato varieties on moorland, sand, and fen soils in the Bremen district of north-western Germany [cf. *R.A.M.*, vii, p. 534], the early Tafelkönig was extensively affected by *Phytophthora infestans*, while Alpha and Eigenheimer were less severely attacked. Sprain was observed in a sporadic form on Sonnenragis. Böhm's allerfrüheste Gelbe again showed a tendency to a thickening of the tubers associated with hollow heart. Modrow's Johanssen and Preussen were immune from wart disease [*Synchytrium endobioticum*] and Veenhuizen's Roode Star practically so. Scab [*Actinomyces scabies*] was only observed on Böhm's Edeltraut on sandy soil.

Esmarch (F.). **Ringkranke Kartoffeln.** [Ring-diseased Potatoes.] —*Die Kranke Pflanze*, vi, 1, pp. 7–9, 1929.

Popular notes are given on the bacterial and fungal ring rots of potatoes caused, respectively, by *Bacterium sepedonicum* and *Verticillium albo-atrum* or *Fusarium oxysporum* [*R.A.M.*, vii, pp. 50, 467]. Both types of disease are transmissible through infected tubers to the progeny, and the fungal ring rot may reduce the yield by as much as 50 per cent.

White (R. P.). **Potato experiments for the control of Rhizoctonia, scab, and blackleg 1922 to 1927.**—*Kansas Agric. Exper. Stat. Tech. Bull.* 24, 37 pp., 1928. [Received May, 1929.]

Experiments [full details of which are given] conducted from 1922 to 1927 in the Kaw valley, Kansas, upon the seed treatment of potatoes against *Rhizoctonia* [*Corticium solani*: *R.A.M.*, vii, p. 262] showed that immersion either in a 1 in 1,000 cold corrosive sublimate solution for $1\frac{1}{2}$ hours, or in a warm 1 in 120 formaldehyde solution at 124° to 126° F. for 3 to 4 minutes gave satisfactory results. The treatment should be applied in the autumn or at least one month before planting, to avoid the delay in germination that results from spring treatment and reduce shrinkage in storage.

If autumn treatment is practised, the tubers should be thoroughly dry before storing, for which reason the hot method is preferable at this season, as it enables a car-load of potatoes to be treated, dried, and stored in one day. Autumn or winter treatment also eliminates induced dormancy and injury to the sprout.

Scab [*Actinomyces scabies*] was reduced by applications to the soil of green manures and sulphur, green crops ploughed under during spring proving the most effective.

Certain organic mercury compounds gave very satisfactory control of *C. solani* and blackleg [*Bacillus atrosepticus*] when used as instantaneous dips [loc. cit.].

BOTJES (J. O.). **Iets over het verband tusschen het 'blauw' van de Aardappelknollen en kaligebrek.** [Notes on the connexion between 'blueing' of Potato tubers and potash shortage.]—*Tijdschr. over Plantenziekten*, xxxv, 1, pp. 5–8, 1929.

The blue spotting of potatoes, which in Holland results when the tubers are subjected to pressure or violent shaking [*R.A.M.*, vi, p. 633], has been found to depend primarily on two factors, namely, the deficiency of potash in the soil and the lack of turgor through loss of water during germination.

The following test was carried out to determine the effect of shock on the incidence of blue spotting on Triumph tubers. Twenty tubers from each of seven lots of plants grown (*a*) on plots receiving a sufficiency of potash, and (*b*) on plots to which no potash had been applied for years, were dropped six times in succession on a concrete floor from heights varying from 10 to 70 cm. The highest number of blue-spotted tubers in both classes occurred at a fall of 60 cm. (20 in the potash-deficient lot and 16 in the normal); at 30, 40, and 50 cm. the potash-deficient lots contained 16 affected tubers each and the normal 8, 8, and 16, respectively. The total number of potash-deficient tubers contracting blue spotting in this experiment was 102 out of 140, the corresponding number of normal ones being only 48. The importance of shock in the causation of the spotting is shown by the fact that the phenomenon was not observed on tubers not dropped from a height even when these were grown on plots receiving no potash. The blue spotting invariably developed at the hilum, where the tubers ordinarily struck the cement floor. In another test 120 potash-deficient tubers were dropped in such a way that the top struck the floor, and in this only 57 developed blue spotting.

Investigations made in 1926–7 showed that a deficiency of potash in the soil induces a diminution of turgor, which in its turn renders the tubers susceptible to shock. It is further possible that a shortage of potash causes a modification in structure which prevents the adequate development of the supporting tissues.

VAN DER WAAL (G. A.). **Het blauw worden der Aardappelen.** [The 'blueing' of Potatoes.]—*Tijdschr. over Plantenziekten*, xxxv, 2, pp. 60–68, 1929.

The results [which are tabulated and discussed] of a series of tests carried out in Holland in 1926 and 1927 showed that liberal applications of potash (500, 750, or 1,000 kg. per hect. of the so-called patent potash, and 400, 600, or 800 kg. per hect. of 40 per cent. potash salt) greatly reduced the incidence of 'blueing' in potatoes (Bravo in 1926 and Eigenheimer in 1927) [see preceding abstract]. The disease was increased by the application of nitrogenous fertilizers in one case only, when the plots received 800 kg. per hect. of Chile saltpetre for two successive years, and no potash. The results of a varietal susceptibility test showed that Bravo Seedling 2649, de Wet, Roode Star, Bonte Roode Star, and Monocraat are more liable to develop blueing in the absence of potash than Zeeuwsche Blauwen, Alpha, Industrie, and Bevelanders.

ISHIYAMA (S.). **Bacterial leaf blight of the Rice plant.**—*Proc. Third Pan-Pacific Sci. Congr.*, Tokyo, *1926*, ii, p. 2112, 1928. [Received May, 1929.]

Bacterial leaf blight is stated to be a widespread and serious disease in the rice fields of central and south-western Japan, where it has been under observation since 1908. The first symptom of infection is the appearance of small water soaked lesions on the leaf margins, which gradually enlarge to yellowish or whitish blotches or stripes and generally bear an exudate of clouded droplets, gradually hardening into yellowish resinous granules.

The causal organism of the disease was identified by the writer in 1917 as a bacterium to which the name of *Pseudomonas oryzae* Uyeda and Ishiyama is given. It occurs singly or in pairs in the form of short rods with rounded ends, 0·5 to 0·8 by 1 to 2 μ, motile by a polar flagellum; forming round, smooth, glistening, wax-yellow colonies on nutrient agar plates; producing slight acidity in milk and acid without gas in cultures with various carbohydrates; not liquefying gelatine or reducing nitrates; aerobic and Gram-negative; optimum temperature for growth 26° to 30° C. The group number, according to the chart issued by the Society of American Bacteriologists, is 5020/31005/X222.

The veins of the affected tissues and the exudates were found to be teeming with the organism, with which a saprophytic bacterium is usually associated. Infection seems to occur through wounds, the organism being conveyed to the leaves by insects or the wind and overwintering on dead foliage or in the soil. The selection of resistant varieties and the application of suitable fertilizers appear to be the most promising control measures.

SUEDA (H.). **Studies on the Rice blast disease.**—*Rept. Dept. Agric. Govt. Res. Inst. Formosa*, 36, 130 pp., 5 pl., 3 figs., 1928. (Japanese.) [Abs. in *Japanese Journ. of Botany*, iv, 3, p. (73), 1929.]

The symptoms of rice blast (*Piricularia oryzae*) [*R.A.M.*, viii, p. 263] are stated to be most prominent on the leaf blades and panicles, but noticeable also on the caryopses, young roots and buds, leaf sheaths, culm nodes, and pedicels.

The dimensions of the conidia were found to vary according to moisture and temperature conditions, being long and narrow in warm, humid surroundings, small and broad in the reverse conditions. During one night more than ten conidia may develop on one conidiophore; germination takes place in 12 to 16 hours at temperatures of 15° to 30° C. (optimum 25° to 28°), dry conditions and an acid reaction of the medium favouring the process. Direct sunlight was observed to impede the growth of *P. oryzae* at all stages. Both hyphae and conidia are fairly resistant to dry heat. Thus, only half the conidia exposed dry to a temperature of 60° for 30 hours were killed, while all those placed in water at 50° for 13 to 15 minutes were destroyed.

Appressoria are generally produced at the apex of the germ-tubes on germination. These bodies, generally taken for chlamydospores, are thick-walled cells secreting a mucilaginous substance enabling

them to adhere to certain parts of the host. The penetrating hyphae enter the host both through the stomata and directly into the epidermal cells. The conidia were found to retain their viability for a year on the host out of doors and for two years on nutrient media; they may also live some time floating on the water covering the rice fields, but die within two weeks when submerged.

Various measures of control are discussed.

BOBILIOFF (W.). **Onderzoekingen over den meeldauw bij Hevea brasiliensis.** [Investigations on mildew in *Hevea brasiliensis.*] —*Arch. voor Rubbercult. Nederl.-Indië*, xiii, 1, pp. 1–43, 9 figs., 1 chart, 1929.

Rubber mildew (*Oidium*) [*heveae*] has been observed to pass the west monsoon in west Java on the young leafy shoots that develop in the crown of some of the trees during this period. The results of an extensive survey [the data from which are tabulated and discussed] showed that both the number of trees bearing these late shoots and the incidence of mildew on them vary considerably during the season in question: the disease appears to be at its lowest ebb during November and December. From the end of April onwards infection steadily increases, so that shortly before the time of normal leaf fall the fungus is present in large quantity in the plantations. Under favourable weather conditions for the development of *O. heveae* defoliation occurs during the dry season, when the fresh leaves of the main foliage are produced.

A careful investigation of the development of the fungus on the leaves of the late shoots showed that it spreads from one leaf to another, and from the affected trees to others in close proximity, so that any tree attacked in this manner is a potential centre of infection. For about five weeks *O. heveae* remains in a virulent condition on the leaves. Gradually the intensity of infection declines, the conidia and later the mycelium die off, and finally the only trace of the fungus is the brown or reddish-brown spots on the leaves.

A series of experiments was conducted in the control of mildew (*a*) by the removal of the late shoots before the time of normal leaf fall (the critical period for infection); (*b*) by spraying the shoots with a solution of sulfinette [*R.A.M.*, viii, p. 125] with a resin-soda adhesive; and (*c*) the same applied to the whole tree. Some degree of control was achieved by the first-named method, which is practicable and inexpensive, but spraying proved a complete failure, and until the technique of this operation is improved and the expenditure reduced it cannot be recommended. Attention should, however, be paid to the possibilities of control by means of dusts, e.g., sulphur dust, which can be applied to the trees from aeroplanes or by means of a specially constructed apparatus.

Attempts are also in progress to control rubber mildew by the selection of resistant plants obtained by grafting various species of *Hevea*, e.g., *H. collina*, *H. guyanensis*, and *H. spruceana* on to stocks of *H. brasiliensis*.

SALMON (E. S.) & WARE (W. M.) **The downy mildew of the Hop in 1928.**—*Journ. Inst. of Brewing*, N.S., xxvi, 1, pp. 20–25, 2 figs., 1929.

That systematic spraying with Bordeaux mixture is necessary for the control of downy mildew of hops [*Pseudoperonospora humuli*] was first recognized in England after the disastrous epidemic of 1927, when even those gardens where the spiked growths had been removed were severely attacked.

During 1928, the disease appeared in Kentish gardens in April, when basal spikes bearing spores were seen; in one average case, 20 bushels were collected from a garden of 20 acres. Where infection was most severe all the hills were diseased, and many produced 10 to 20 basal spikes. This was followed by an attack on the growing tips of the bines, with the result that by the end of May and during June the development of terminal spikes was unprecedented. Not infrequently, 30 to 40 basal spikes emerged from the hill during this period, while in gardens of the most susceptible varieties every hill showed both terminal and basal spikes.

As it is impracticable to destroy the primary basal spikes by spraying, growers should, wherever possible, collect and destroy the first ones before they can form spores and infect the adjacent shoots. Also, as it is possible that infection is carried on the hands, the same person should not both collect spikes and train up the bines.

Though the shortage of bine resulted in places in a much diminished crop, the situation was saved by the hot, dry summer; the terminal and lateral spikes failed to produce spores, there was no brown, angular spotting of the upper leaves, and the cones were perfectly healthy when gathered.

For the control of the disease four applications of Bordeaux mixture are recommended, of which the first should be given when the bines are three-quarters up the strings or poles [cf. *R.A.M.*, vii, pp. 196, 400].

When the bine was near the 'bar-string', most growers applied the mixture from the ordinary hop-washer machines used against *Aphis* attack. In other gardens tractor or horse-drawn machines with the pumps operated from the wheels, or motor washers, in which they were operated by a motor mounted on the tank, were used. From 70 to 100 galls. of fluid per acre were adequate, the machines being worked at fairly high pressures (up to 150 lb. in some instances) to secure the necessary fine, misty spray. When the hops hung down over the top wire, longer extension rods were provided on the revolving framework.

No damage resulted when the hops were sprayed in the 'pin' stage; spraying was discontinued during burr, as it would have killed the 'brush' and prevented fertilization, and the dry weather rendered later spraying unnecessary.

Usually, the spraying caused slight injury, especially if much liquid was applied to the growing tips of the bines; the third and fourth pairs of leaves from the top showed brown edges and brown, dead areas between the veins. Numerous minute, pale spots and punctures on the leaves are also attributed to the mixture. Severer

scorching of the young leaves was probably caused by the spray being applied after heavy aphid infestation. No injury was caused to the cones.

These results are considered to show that spraying can be satisfactorily carried out with the ordinary hop-washers at present available to most growers.

SALMON (E. S.) & WARE (W. M.). **The downy mildew of the Hop in British Columbia.**—*Brewers' Journ.*, lxv, 763, p. 49, 1929.

During July, 1928, downy mildew (*Pseudoperonospora humuli*) was widely prevalent on cultivated hops at Sardis, British Columbia, and specimens received by the authors quite agreed with European material. The disease was checked by spraying with Bordeaux mixture, but in one garden where infection was very severe, dusting with finely powdered copper sulphate and hydrated lime (20–80) gave much better control.

From the prevalence of diseased spikes in 1928 it is surmised that the fungus was present at Sardis in 1927 or earlier; as the disease appears to be unknown in hop gardens in the United States it was probably imported into Canada in or on hop sets obtained from Europe.

BELL (A. F.). **A key for the field identification of Sugar Cane diseases.**—*Queensland Bureau of Sugar Experiment Stations, Div. of Path. Bull.* 2, 63 pp., 28 pl. (2 col.), 1929.

This very valuable publication gives a lucid and admirably illustrated account of the fungous, bacterial, and physiological diseases of sugar-cane, with references to their etiology (where known) and distribution in the sugar-growing countries of the world.

COOK (M. T.). **The gummosis of Sugar Cane.**—*Journ. Dept. Agric. Porto Rico,* xii, 3, pp. 143–179, 5 pl. (2 col.), 1928. [Issued February, 1929.]

After a brief survey of the history and geographical distribution of the gumming disease of sugar-cane (*Bacterium vascularum*), and a fuller review of the existing literature on the symptoms of the disease [much of which is cited verbatim], the author describes in some detail the appearance of diseased cane in Porto Rico, and the work carried out there under field and experimental conditions with the main purpose of determining the varietal resistance of the sugar-canes commonly grown in the island. Brief notes are also given on the cultural characters of the organism and the results of inoculations made with it.

The disease is very destructive to young canes, and causes a reduced yield in tonnage, varying with the susceptibility of the variety and with the severity of the attack. The percentage of infection is higher in fields planted with cuttings (plant cane) than in ratoon fields, but in every case investigated the yield of the ratoons was reduced as compared with the first crop. The leaf symptoms were more pronounced in wet than in dry weather. Many of the best commercial varieties used in Porto Rico are immune from, or highly resistant to, the disease, and wherever

such varieties are planted the disease is not a serious problem. Care should be taken never to use infected cuttings for commercial plantings.

COOK (M. T.). **Sugar Cane gummosis.**—Reprinted from *The 1928 Ref. Book Sugar Ind. of the World*, 4 pp. [Received March, 1929.]

This is an abridged version of the author's account of the gumming disease of sugar-cane (*Bacterium vascularum*) in Porto Rico [see preceding abstract]. The main point of interest in this paper is a list of sugar-cane varieties arranged in decreasing order of susceptibility to the organism, among which the following may be mentioned for their resistance: S.C. 12/4, B. 208, P.O.J. 979, P.O.J. 826, P.O.J. 234, P.O.J. 228, B.H. 10 (12), and Uba, besides several of the P.R. varieties. In terminating the author states that under the present conditions in the island, where there are a number of resistant varieties in use, which are far better than the susceptible varieties, there should be no difficulty in controlling the disease.

ASHBY (S. F.). **Gumming disease of Sugar-cane.**—*Trop. Agriculture*, vi, 5, pp. 135–138, 1929.

After a brief reference to his previous account of the occurrence of the gumming disease (*Bacterium vascularum*) of sugar-cane in St. Kitts and St. Lucia [*R.A.M.*, v, p. 518], the author gives a detailed description of his study in pure culture of two strains of yellow bacteria which were isolated from affected material in St. Kitts. The first showed cultural differences from *Bact. vascularum* as described by E. F. Smith and was not, therefore, used in subsequent inoculation work. It produced in three to four days entire, convex, at first colourless but later pale yellow colonies which, on agar slants, gave a straw or amber-yellow, abundant slimy growth with a marked tendency to run down. The second, more slowly growing strain resembled that described by Smith except in some minor cultural characters. It produced entire, flat, deeper yellow colonies which gave a restricted, aniline to primuline yellow growth on the same medium, with a compact slime showing little tendency to flow. Inoculations with this strain on young ratoon shoots of four varieties of sugar-cane caused the development of long, narrow, pale, sharply defined, translucent stripes, about 2 mm. in width, on the inoculated leaves, to which they remained restricted for several months, without any withering of the hearts or any rotting of the apical internodes. Five months after inoculation, isolated red streaks due to infection of single vascular strands could be traced down some of the leaf sheaths, and were continued into one or more of the internodes.

Inoculations made at the same time with an isolation from 'gummed' sugar-cane from New South Wales resulted in the formation of broader leaf stripes with more diffused margins on the inoculated leaves, and withering of the hearts and rotting of the apical internodes of the B. 156 and Badilla varieties. This organism appeared to be more actively pathogenic than the second St. Kitts isolation mentioned above, as it both invaded the vessels

of the xylem of vascular bundles, and caused a necrosis of the parenchyma of young leaves and of the apical internodes of the stems. The cultural characters of this bacterium [which are described in detail] are similar to those of the first strain isolated from St. Kitts, and it is believed that both are identical. As no evidence was obtained that in culture the first type could change into the second, or vice versa, it would appear that the gumming disease of sugar-cane may be caused by two yellow forms, which, in some cases, may occur together, and which may be considered as distinct varieties of *Bact. vascularum*.

In referring to North's work on the mode of infection and dissemination of gumming disease in Australia, the author states that his observations in St. Kitts and St. Lucia support the view that infection may be confined to the leaves of some resistant varieties. Varieties showing an appreciable amount of leaf striping should be considered as semi-resistant, and should not be allowed to occupy a large part of the areas under sugar-cane. The gumming disease is known to occur in Australia, Fiji, Mauritius, Porto Rico, St. Kitts, St. Lucia, and Colombia [to which recent observations add Dominica, Antigua, and Guadeloupe: see next abstract].

Examination of a culture supplied by North of the organism described by him as the pathogen of leaf scald in Australia [ibid., vi, p. 120] (apparently identical with the disease described earlier by Wilbrink in Java under the name 'gomziekte'), showed it to be an actively motile bacterium with a single polar flagellum three to five times the length of the rod. As this organism has not been hitherto named, the binomial *Bact. albilineans* is proposed for it, on account of the long white stripes of uniform width formed by it on the leaves, which are characteristic of the disease. The latter is present in Australia, Fiji, Java, the Philippines, Mauritius, and probably in Formosa. Brief notes are also given on the red stripe disease of sugar-cane in the Hawaiian Islands, caused by *Phytomonas rubrilineans* [ibid., viii, p. 265].

WILLIAMS (C. H. B.). **La gommose de la Canne: son apparition à la Guadeloupe.** [The gumming disease of Sugar-cane: its appearance in Guadeloupe.]—*Journ. Stat. Agron. Guadeloupe*, vii, 2, pp. 106-111, 1929.

A survey made in March, 1929, of plantations of the Ba. 11569 variety of sugar-cane in Guadeloupe showed them to be fairly generally attacked by the gumming disease (*Bacterium vascularum*) [see preceding abstracts], this being the first record of the disease in the island. The wide occurrence of the trouble would indicate that it is of several years standing, and it is believed that it was introduced with clandestine importations of sugar-cane from infected countries into Guadeloupe. The main line of control should consist in the replacement of the very susceptible Ba. 11569 variety by resistant ones, such as B.H. 10 (12), S.C. 12/4, and G. 119.

SHEPHERD (E. F. S.). **Remarques à propos de certaines opinions émises dans un article de M. A. de Villèle dans la Revue Agricole de l'Île de la Réunion, pour Novembre 1928, sous**

le titre 'L'Île Maurice et les maladies de la Canne'. [Observations in connexion with certain opinions expressed in an article by M. A. de Villèle in the *Revue Agricole de l'Île de la Réunion* for November, 1928, under the title 'The Island of Mauritius and Cane diseases'.]—*Rev. Agric. de l'Île Maurice, 1929*, 43, pp. 10–11, 1929.

Referring to a statement made by A. de Villèle in *Rev. Agric. de l'Île de la Réunion*, November, 1928, to the effect that the presence of gummosis and leaf scald of sugar-cane [*Bacterium vascularum* and *Bact. albilineans*: *R.A.M.*, viii, pp. 64, 65, and preceding abstracts] has only just been established in Mauritius, the author admits that this is correct as regards the latter disease. Gummosis, however, has been known to occur in Mauritius since the time of Bonâme, and is mentioned in E. F. Smith's 'Bacteria in relation to plant diseases', vol. iii. The recent paper in *Rev. Agric. de l'Île Maurice* [loc. cit.] was merely designed to emphasize various aspects of the disease on which fresh light has been thrown by recent researches.

Replying to criticisms from the above-mentioned source on the uncertainty of his diagnosis of 'pokkah boeng' in Mauritius [ibid., viii, p. 134], the writer considers that the obscure nature of this disease, which may assume a variety of forms, precludes any more definite statement at present. In any case the condition is of no serious importance. There is no evidence that 'pokkah boeng' is connected with top rot or heart rot.

PRIODE (C. N.). **Target blotch of Sugar Cane. A new Helminthosporium disease.**—*Facts about Sugar*, xxiv, 16, p. 376, 1929.

During the past two years an apparently new disease of sugarcane has been observed on various plantations in Cuba. Infected leaves develop large necrotic blotches with irregular, concentric rings, roughly resembling a target board in appearance; hence the name of 'target blotch' has been applied to the condition. Isolation and inoculation experiments have shown that the disease is due to a species of *Helminthosporium*.

The first symptom of infection is the development of small red spots, usually with minute, sharply defined, sunken streaks in the centre. These spots rapidly enlarge and sometimes coalesce into rusty brown or dark straw-coloured blotches closely resembling those associated with brown stripe [*H. stenospilum*: *R.A.M.*, viii, p. 134]. When infection occurs on the young leaves rolled in the apical shoot the spots usually enlarge, forming zonate markings of irregular concentric rings; in other cases the fungus penetrates the successive layers of rolled leaves to the centre of the spindle, generally causing the death of the whole roll of leaves. No leaf sheath or stalk infection has been noticed, but the mid-rib appears to be readily attacked. The symptoms of target spot are usually observed in Central Baragua about the 10th to 15th December, and they increase in prevalence and severity as the dry, cool season advances. With the advent of warm, rainy weather in the spring the infection gradually declines, and the young, rapidly growing ratoon canes appear to be immune. The

most susceptible varieties are C. 760, C. 228, C. 145, C. 69, P.R. 760, P.R. 724, and H.E. 45; S.C. 12/4 and Cristalina are readily but not severely infected, and the new P.O.J. varieties seem to be immune.

MARTIN (J. P.). **Fungicidal dust tests against eye spot disease.** —*Hawaiian Planters' Record*, xxxiii, pp. 46–55, 1929. [Abs. in *Facts about Sugar*, xxiv, 17, pp. 394–395, 1929.]

Continuing his experiments in Hawaii on the control of eye spot disease of sugar-cane [*Helminthosporium sacchari*: *R.A.M.*, viii, p. 266], the author obtained the best results with sulphur plus 1 per cent. potassium permanganate applied at weekly intervals during the winter months. The efficacy of any dust against eye spot was found to depend largely on the amount of rainfall and frequency of application during wet weather. Before testing dusts on a commercial scale, the average number of lesions per leaf should be kept below 60 in the experimental plots. A direct correlation was found to exist between temperature and cane growth, which increased and decreased simultaneously, and also between rainfall and eye spot counts.

FAWCETT (G. L.). **Manera de determinar los lugares infestados por la enfermedad del ananás de la Caña de azucar.** [Mode of determining the sites infected by the pineapple disease of Sugar-cane.]—*Rev. Indust. y Agric. de Tucumán*, xix, 7–8, pp. 213–214, 1929.

In order to determine whether pineapple disease of sugar-cane [*Thielaviopsis paradoxa*] is present in the plantations, a small number of setts (free from insect infestation) should be cut down to two or three internodes and planted out. Ten days later the interior of the setts planted in damp, infected soil in warm weather will have turned into a black, semi-liquid mass. Another method of obtaining similar results would be to leave the canes for one or two months after planting, when they should be removed and examined.

MOURASHKINSKY (K. E.) & SIELING (M. K.). Материалы по микофлоре Алтая и Саян. [Materials for the mycoflora of Altai and Sayany.]—Reprinted from *Труды Сибирского Инст. С.-Х. и Лесоводства.* [*Trans. Siberian Inst. of Agric. and Sylviculture*], Omsk, x, 4, 31 pp., 1928. [Received April, 1929.]

This is a preliminary list of 506 species of fungi [for the most part parasites] which were found in the course of expeditions between 1925 and 1927 in the Altai and Sayany mountains of Western Siberia. The fungi enumerated include 10 species of Phycomycetes, 5 Exoascaceae, 10 Erysiphaceae, 84 Pyrenomycetes, 32 Discomycetes, 145 rusts, 22 smuts, 3 Exobasidiaceae, 83 Sphaeropsidaceae and Melanconiaceae, and 43 Hyphomycetes. Of these, 51 species are listed as new to science, their descriptions by the authors, Petrak and others, being reserved for separate publication. The hosts or natural substrata are indicated in every case.

The last few pages of the paper are devoted to a general discus-

sion of the character of the mycoflora on the mountains investigated, the altitude of which varies from 900 to 2,900 m., and also to a discussion of its probable affinities.

KAWAMURA (S.). **On some new Japanese fungi.**—*Japanese Journ. of Botany*, iv, 3, pp. 291–302, 1 col. pl., 22 figs. (6 col.), 1929.

Of the five new Japanese fungi described in this paper the following three are of phytopathological interest. A fungus with a thick, leathery, smoky black mycelium was observed as a parasite on a bamboo (*Bambusa shimadai*) culm at Heito, Formosa. The globose, blackish perithecia imbedded in the mycelial layer measure 0·8 mm. in length (including the prolonged beak) and 0·5 mm. in diameter, and contain numerous cylindrical, curved asci, 300 to 450 by 25 μ, with slender, multiseptate protecting paraphyses. Each ascus contains eight blackish-brown ascospores, divided by several (usually seven) septa and measuring 70 to 120 by 14 to 15 μ. The blackish-brown, multiseptate, thick-walled conidia measure 150 to 300 by 20 to 25 μ. This organism, which produces a 'panther-figured' pattern on the affected plants, closely resembles the so-called 'tiger-figured' fungus (hitherto known as *Miyoshia fusispora*), but a comparison of the fructifications reveals decided differences. In the tiger-figured fungus the perithecia measure 5 to 6 by 3 to 4 mm., the asci 190 to 220 by 12 μ, the short fusiform ascospores 28 to 38 by 6 to 8 μ, and the conidia 50 to 120 by 5 to 15 μ. These and other points [which are briefly indicated] render the microscopical differentiation of the two species quite easy, while even to the naked eye the tiger-figured pattern is characterized by large, isolated spots, and the panther-figured by extensive dark areas with a confused grouping of small darker spots. Moreover, the tiger-figure is believed to be confined to one host, *Semiarundinaria fastuosa*.

Discussing the taxonomy of these two fungi [technical diagnoses of which are given in English], the writer places both among the Sphaeriaceae. The name of the genus *Miyoshia* is changed to *Miyoshiella* in order to avoid confusion with a flowering plant, the tiger-figured fungus being named *M. fusispora* and the panther-figured *M. macrospora*.

Micropeltis bambusicola, which produces the so-called 'Chinese-figured' pattern on bamboo (*Sasa paniculata*), has recently been reported from the island of Kyushu on *Semiarundinaria fastuosa*, this being the first record of its occurrence in Japan. The fungus is characterized by the absence of a visible mycelium and by the small size of the infected areas.

A recent inspection by the writer of the type specimen of *Isaria arachnophila* at Kew Gardens Herbarium confirmed Yasuda's conclusion (*Bot. Mag.*, Tokyo, xxvi, 1917) that the fungus found by him as a parasite on earth-spiders (*Atypus* sp.) was a distinct species, *I. atypicola*. This was long believed to be the only fungus parasitic on spiders in Japan, but the writer has frequently observed an entirely distinct species on a different spider, viz., *Pachylomerus fragaria*. This fungus, as yet apparently undescribed, is named *I. pachylomera* n. sp. (with an English diagnosis), and is character-

ized by a thick, white, cocoon-like stroma completely encasing the body of the spider (while *I. atypicola* is depicted as springing from the head of the fully visible host), and by straight, oblong conidia measuring 4 to 5 by 2 μ, whereas those of *I. atypicola* are distinctly curved.

HIRATSUKA (N.). **Thekopsora of Japan.**—*Bot. Mag.*, Tokyo, xliii, 505, pp. 12–22, 1929.

Notes and a key for identification are given of ten species of *Thekopsora* hitherto recorded in Japan.

JENKINS (A[NNA] E.) & HORSFALL (J. G.). **A comparison of two species of Plectodiscella.**—*Mycologia*, xxi, 1, pp. 44–51, 2 figs., 1929.

The authors examined a culture of the fungus isolated by Osterwalder from what he believed to be Jonathan apple spot in Switzerland [*R.A.M.*, vi, p. 38] and found it to possess the distinctive morphological characters of the genus *Plectodiscella*, as exemplified by *P. veneta* which has been recently demonstrated to be referable in its vegetative characters to the form genus *Sphaceloma* [ibid., iv, p. 476]. The Osterwalder fungus is also similar in culture to the other forms of *Sphaceloma* studied by them. A comparison of the culture with specimens from the type material of *P. piri* Woronichin and a review of the information contained in Osterwalder's and Woronichin's papers on the organisms described by them lead to the conclusion that both are identical, and it is stated that in a preparation from one of the specimens of the Russian fungus a mass of unattached conidia was seen in addition to the mycelial growth and asci described by Woronichin. For these reasons the Osterwalder fungus should, in the author's opinion, be referred to *P. piri*.

Osterwalder's description of the growth of the fungus in pure culture and Woronichin's description of the ascomata of this species and of the family Plectodiscelleae are reproduced verbatim.

GADD (C. H.). **Report of the Mycologist.**—*Tea Res. Inst. Ceylon Bull.* 3 (*Ann. Rept. for the year 1928*), pp. 8–17, 2 pl., [1929.]

Poria hypolateritia [*R.A.M.*, vii, p. 745] continues to be the commonest root disease of tea in the up-country districts of Ceylon, and is also the most difficult to eradicate. It is unknown on young seedlings, and plants are probably immune until they are two or three years old. When small *Poria* patches were replanted after the dead bushes had been dug out, the supplies were attacked by the disease, though no further deaths occurred in the original planting. Infected areas should be isolated by trenches and left bare for at least 12 months after the last diseased bush has been removed, before supplying. The removal of all infected roots is insufficient to eradicate the fungus from the soil.

Armillaria fuscipes [ibid., viii, p. 267] killed mature tea bushes in three districts. The symptoms caused by this fungus are similar to those described as due to *A. mellea* elsewhere [ibid., viii, p. 202], though the infected roots do not always split. The peculiar cracks

found on infected roots of *Albizzia lophantha* and young tea plants were not prominent on mature tea. The diseased roots invariably showed cords or sheets of mycelium in the cortex or on the surface of the wood, and black rhizomorphs resembling small roots, about $\frac{1}{10}$ in. in diameter, were always present. No fructifications were found on tea either in the field or on roots in the laboratory.

It is very probable that several distinct diseases are known as *Diplodia* disease [*Botryodiplodia theobromae*: ibid., viii, p. 203], but it is doubtful whether all are caused by this fungus.

Several cases of true branch canker (*Macrophoma theicola*) [ibid., v, p. 633] were observed on low-lying lands, some of the branches, owing to the weakness induced, also being affected by red rust (*Cephaleuros parasiticus*).

A leaf disease on an estate in the Kalutara district was caused by *Rhizoctonia* [*Corticium*] *solani*. In some cases, entire leaves were killed; in others the injury was restricted to large areas of the leaf surface. The diseased areas turned brown or greyish-brown and somewhat resembled brown blight [*Glomerella cingulata*] except that they were not zoned. The organism is a soil fungus which reaches the leaves by travelling up along the stems and leaf stalks.

GADD (C. H.). **The treatment of the Poria root disease.**—*Tea Quarterly*, ii, 1, pp. 16–21, 2 pl., 1929.

The writer recapitulates the method for the control of red root disease of tea (*Poria hypolateritia*) by means of the isolation of infected areas [see preceding abstract]. The trenches constructed for this purpose should include at least two rows of apparently healthy bushes within the isolated area. Determinations were made under laboratory conditions of the rate of growth of *P. hypolateritia* in acid soils to which varying amounts of lime had been added, and it was found that the most rapid development occurred at a hydrogen-ion concentration of P_H 6·24 to 6·46, representing an application of lime at the rate of 5 tons per acre. On the other hand, a retardation of growth was effected by applications of sulphur (2 tons per acre). The fungus was shown by laboratory experiments to be capable of persisting for some months in the soil without any apparent source of nutriment from roots.

GADD (C. H.). **Pruning in relation to wood rot of Tea.**—*Tea Quarterly*, ii, 1, pp. 10–16, 1929.

Full directions are given for the control of wood rot and branch canker of tea [*Ustulina zonata*, *Aglaospora aculeata*, and other fungi: *R.A.M.*, vii, p. 745] by systematic pruning and by dressing the wounds with various protective compounds, e.g., a mixture of Skene's wax and tar, or a good white lead paint in linseed oil.

NOLLA (J. A. B.). **The black-shank of Tobacco in Porto Rico.**—*Journ. Dept. Agric. Porto Rico*, xii, 4, pp. 185–215, 6 pl., 1928. [Issued February, 1929.]

This is a full account of the investigation started in 1926 of a tobacco disease in Porto Rico, locally known under the name 'pata

prieta' and believed to be probably the same as black shank in the United States [*R.A.M.*, viii, p. 409] and the 'lanas' or 'bibit' disease of the Dutch East Indies, caused by *Phytophthora nicotianae*. In Porto Rico the disease is stated to have been destructive during the last few years on tobacco, especially of the cigar-wrapper varieties. The chief pathological symptoms are a severe seed-bed rot and seedling blight, a rotting of the transplants, a blackening of the basal parts of the stems of plants at all stages of development, and a leaf spot on adult plants. Isolations from diseased tissues yielded an organism which is identified as *P. nicotianae*. It differed in some morphological features from a strain of the organism responsible for black shank in Florida, but no essential differences were noticed between the two in cultural characters or in pathogenicity. The morphological study of the two strains was based chiefly on the size of the sporangia; the size of the chlamydospores was found to be of no value in the separation of the strains. Only a few oospores were seen and they are not described, but in the two from the Porto Rican organism that are figured the antheridia are shown to be paragynous [cf. ibid., vii, p. 601].

Inoculation experiments showed the fungus to be capable of infecting tobacco, *Ricinus communis*, potato, and also pepper [*Capsicum annuum*], tomato, and eggplant seedlings. A non-commercial mammoth variety of tobacco and the Connecticut Round Tip commercial cigar-wrapper variety proved to be the most susceptible of all those tested, while a Porto Rican cigar-wrapper variety and new strains from it were very resistant. The F_1 generation of crosses between susceptible or slightly resistant varieties was very susceptible, while that of crosses of resistant with susceptible varieties was more resistant than the susceptible parents.

Field observations indicated that moisture is a dominating factor in outbreaks of damping-off caused by the fungus, and that irrigation water is an important agent in the spread of the disease from one field to another. The main sources of infection are tobacco-plant débris left over from the preceding crop, and infected manure, on which the fungus may live in the soil as a saprophyte for at least five or six years. Crop rotation is therefore impracticable under Porto Rican conditions. The control measures recommended are the immediate removal from the field of all diseased plants; a rigid selection of seedlings before transplanting in the fields, the dipping of healthy seedlings from infected beds in a 4–4–50 or 5–5–50 Bordeaux mixture before setting out, and the selection and breeding of resistant varieties.

JONES (J. P.). **The effect of other crops on Tobacco.**—*Journ. Amer. Soc. Agron.*, xxi, 2, pp. 118–129, 1929.

In connexion with his experiments in Massachusetts on the influence of various cropping systems on tobacco root rots [*R.A.M.*, vii, p. 810], the author has kept records on the relative severity of brown root rot under the different rotation schemes. Tobacco growing in continuous culture without a cover crop showed 18 per cent. brown root rot, compared with 73 per cent. when a timothy

[*Phleum pratense*] cover crop was used. In the animal husbandry rotation, with tobacco following maize and timothy hay, brown root rot occurred on 87 per cent. of the plants. Tobacco grown after potatoes, maize, and hay showed 37, 40, and 44 per cent. of brown root rot, respectively. After onions and tobacco only 3 and 17 per cent., respectively, of brown root rot were observed. The largest yields were obtained after onions and tobacco, where brown root rot was at a minimum, and the smallest in the triennial animal husbandry rotation, where the disease was most severe.

The following observations support the hypothesis that brown root rot is a nutritional disturbance. The disease can be eliminated from the soil by air drying either in the presence or absence of sunlight, indicating that no organism is concerned but suggesting the possibility of a volatile toxin. In the field, brown root rot has been observed to occur on a very definite plan, usually according to previous treatment, as is frequently found with nutritional effects. Burgess (*Rhode Island Agric. Exper. Stat. Bull.* 198, 1924) has associated crop injuries with the presence of toxic aluminium, and it is considered probable that this factor may also play a part in the causation of brown root rot.

The Connecticut Valley soils on which tobacco is grown are very acid, a condition which greatly favours aluminium toxicity. On certain soils the application of heavy doses of superphosphate (a recognized corrective for aluminium toxicity) has completely cured the stunted condition of the diseased plants. It was further shown in a series of water culture experiments that aluminium sulphate, at the rate of 38 parts per mille, is toxic to tobacco, causing a reduction of growth and brown discoloration of the roots similar to that observed in the field.

Ploughing in the crop residues of various plants has been shown to exert a depressing effect on the available nitrogen, and it is thought that brown root rot may possibly be one of the manifestations of this deficiency. The data obtained from a series of nitrate determinations, made weekly during the growing season of tobacco, showed that the least nitrate was found in the animal husbandry rotation, followed by timothy, rye, and redtop [*Agrostis alba*] cover crops, in the order named. Continuous tobacco without a cover crop showed a slightly lower nitrate accumulation than that in the so-called 'money crop' rotation, i.e., tobacco succeeding potatoes and onions. The highest proportion of nitrates was found in the plots growing tobacco every year without a cover crop but with the addition of manure. A close correlation was detected between the amount of nitrates in the soil, the incidence of brown root rot, and the yield. Thus, in the animal husbandry rotation, the percentage of brown root rot was 100 and the yield 860 lb. per acre, the corresponding figures for the manured plots being 17 and 1,763 lb., respectively. The timothy cover crop plots yielded 1,512 lb. of tobacco per acre with about 69 per cent. brown root rot, compared with 1,655 lb. and 5 per cent. disease on the continuous tobacco plots with no cover crop. An exception occurs in the case of the money crop rotation, where there was no depression of nitrates but the yield of tobacco fell to only 1,426 lb. per acre with 50 per cent. of brown root rot.

McMurtrey (J. E.). **Nutritional deficiency studies on Tobacco.** —*Journ. Amer. Soc. Agron.*, xxi, 2, pp. 142–149, 6 figs., 1929.

The malnutritional symptoms manifested by tobacco plants deprived of sufficient quantities of potassium, magnesium, and calcium are described and figured.

The specific symptom of potassium deficiency is a yellowish mottling of the leaves with a bronze or copper overcast appearance. The centres of the mottled areas are usually necrotic, and in the early stages they occur as numerous specks at the tip, round the margins, and between the veins of the leaf. The arrest of growth round the margins leads to a rim-bound condition or curling downward of the tips and margins. The small specks gradually enlarge and fuse, causing a ragged appearance of the margins and tips of the leaves; in extreme cases the entire crop may be lost. The yield and quality of the cured product are materially reduced where potassium hunger is an important factor.

The symptoms arising from magnesium deficiency have been described under the name of 'sand drown' [*R.A.M.*, iv, p. 577]. The lower leaves of affected plants show a characteristic blanching at the tips and margins, the pallor advancing towards the base of the individual leaf and extending, in severe cases, to the upper leaves of the plant.

In calcium deficiency the most striking symptoms occur in the bud or top leaves of the plant. The leaves become diseased as they unfold, and as they grow their tips and margins assume abnormal shapes. In extreme cases death of the terminal bud or growing point occurs.

When all three bases are deficient in the medium the chief symptoms are those of potassium deficiency, but the growth of the plants is greatly reduced—more so than where potassium alone is deficient. When both calcium and magnesium are deficient the most apparent symptoms are those of magnesium deficiency.

Morgan (M. F.). **Tobacco as an indicator plant in studying nutritional deficiencies of soils under greenhouse conditions.** —*Journ. Amer. Soc. Agron.*, xxi, 2, pp. 130–136, 2 figs., 1 graph, 1929.

In the course of a study of nutritional deficiencies of soils in greenhouse pots at the Connecticut Agricultural Experiment Station, it was observed that, contrary to the experience of Valleau and Johnson, tobacco frenching was not confined to plants showing symptoms of nitrogen deficiency or to plots in which nitrogen was omitted from the fertilizer [*R.A.M.*, vii, p. 747].

Jacobs (H. L.). **Injection of shade trees for the control of insects and diseases.**—*Davey Tree Expert Co., Kent, Ohio, Res. Dept. Bull.* 3, 4 pp., 1928. [Received May, 1929.]

Two years' experimental work on the injection of chemicals (using 2,183 quarts of solutions of 26 preparations) into 201 shade trees of 12 species have shown no favourable results except in one case, that of the injection of iron compounds for the cure of lime-

induced chlorosis. Most of the chemicals, in fact, caused severe injury to the trees, especially when injected in large doses. Improved apparatus and methods of injection have been developed and further experiments on similar lines are planned.

PETRI (L.). **Di un nuovo metodo di cura del 'mal dell'inchiostro' del Castagno.** [A new method of control of Chestnut ink disease.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 4, pp. 339–356, 4 figs., 1928.

The author's observations have confirmed Gioda's report of the efficacy of the method devised by Gandolfo for the control of chestnut ink disease [*Phytophthora cambivora*] by laying bare the base of the trunk of affected trees [*R.A.M.*, viii, p. 141]. This arrests the necrosis, as shown by the dryness of the bark at points previously affected and where, without treatment, the bark would be moist and would probably exude a black fluid. New tissues then form at the collar and the proximal parts of the main roots as a result of cambial proliferation, and the new wood produces a protruding rib joining longitudinally the healthy areas of the collar and each main root.

Trees affected by ink disease succumb only when the cambium at the base of the trunk is killed, and this occurs only in the underground part which is protected from the cold. In winter the growth of the mycelium in the parts exposed by Gandolfo's method is retarded and the fungus then dies out, partly, no doubt, as a result of the competition of other organisms less susceptible to cold. The living tissues of the tree react by forming a cork layer in the cortex, while the cambium gives rise to new wood and new cortical elements. As the attack is limited to the collar and main roots at the base of the tree, it is not necessary to expose the latter to a considerable depth. Tests of the permanency of the cure have been instituted, but the author believes that the fungus is unlikely to be able to resume growth so long as the collar remains exposed, and the prospects are, therefore, hopeful. The method may also prove efficacious when applied to other similar diseases such as the early stages of the 'falchetto' disease of mulberry, also probably caused by a *Phytophthora* [ibid., viii, p. 207], and possibly to root rot of walnut which has symptoms suggesting a similar causation [ibid., iii, p. 524; vi, p. 426]. In the root rots of citrus caused by *P. citrophthora* and *P. parasitica* [ibid., vii, p. 557], climatic factors would probably militate against it.

RAO (D. A. R.) & SREENIVASAYA (M.). **Contributions to the study of spike disease of Sandal (Santalum album, Linn.). Part IV. Chemical composition of healthy and spiked Sandal stems.** —*Journ. Indian Inst. Sci.*, xi A, 19, pp. 241–243, 1 graph, 1928.

The results [which are tabulated] of further investigations on spiked and healthy sandal (*Santalum album*) [*R.A.M.*, viii, p. 146], in which stems from the same locality were analysed [by methods which are indicated], showed that diseased stems usually have a lower ash, calcium, and potash content than healthy ones, but contained more nitrogen, phosphorus, and starch. The constituents

are equally subject in healthy and diseased stems to seasonal variations. The average value for any constituent during a given season varies with the locality.

SREENIVASAYA (M.) & NAIDU (G. G.). **Contributions to the study of spike disease of Sandal (Santalum album, Linn.). Part V. Transmission of spike by budding.**—*Journ. Indian Inst. Sci.*, xi A, 19, pp. 244–247, 8 pl., 1928.

Experiments on the artificial transmission of spike disease of sandal (*Santalum album*) by means of buds from a scion from the diseased portion of a partially spiked plant are described. The scion was first used for a bottle-graft on a different stock, and in the course of four days began to send forth dormant buds on both sides of the point of grafting. After a week, one of the buds below the grafting point was budded on to one of the lower branches of the experimental healthy stock, the terminal foliage of this branch being cut back, while the rest of the plant was left undisturbed.

Four days later the bud burst, subsequently making slow growth. A natural shoot appeared a little higher up on the same branch but ceased growing after a time and then, a little more than 4 months after the diseased bud had been inserted, began to develop internodal buds, which in a week (i. e., 131 days from the time of budding) gave shoots with characteristically spiked leaves. Later, the spike took full possession of the shoot.

Of the 79 spiked and 75 healthy (control) buds thus inserted about 10 and 8 per cent., respectively, grew successfully.

SAWADA (K.). **On the wilt disease of Camphor tree.**—*Rept. Dendrol. Soc. Formosa*, xxx, pp. 26–36, 1 pl., 1928. (Japanese.) [Abs. in *Japanese Journ. of Botany*, iv, 3, p. (71), 1929.]

A wilt disease of cultivated camphor trees [*Camphora officinarum*] over ten years old is frequently observed in Formosa. The causal organism is *Fomes lamaoensis*, which is also responsible for brown rot of the roots.

FAULL (J. H.). **A fungus disease of Conifers related to the snow cover.**—*Journ. Arnold Arboretum*, x, 1, pp. 3–8, 1929.

This is a more detailed account of the author's observations on the conifer blight caused by *Phacidium infestans* [*R.A.M.*, vi, p. 202] or a closely related species than that already noticed from another source [ibid., viii, p. 414]. An almost constant occurrence of black microsclerotia on the affected needles in the spring has been observed. The disease was found to have increased to a marked extent from 1927 to 1928 in a series of experimental plots; thus, in ten two-year-old beds of white spruce [*Picea canadensis*] the incidence of infection averaged 47·2 per cent. in the latter year as compared with 18·4 per cent. in the former.

ROESER (J.). **Effect of thinning in sapling Douglas Fir in the Central Rocky Mountain Region.**—*Journ. of Forestry*, xxvi, 8, pp. 1006–1015, 1 fig., 1928.

In overcrowded sapling stands of Douglas fir (*Pseudotsuga taxifolia*) near Denver, Colorado, two-thirds of the trees in the

unthinned plot were infected with 'pitch girdle', a bark disease of unknown etiology. Five per cent. of the trees had been killed by the disease during the three years preceding examination. In three areas which had been thinned, one-third of the trees were found infected. This difference is due in part to the fact that diseased trees were selected for removal at the time of thinning, but is attributed partly also to the fact that the rate of spread of the disease is favoured by dense stocking.

HUBERT (E. E.). **The cause and control of decay in buildings.**—*Bull. Idaho Univ.*, xxiv, 2 (*Forest Exper. Stat. Bull.* 2), 26 pp., 2 figs., 3 diags., 1929.

Popular notes are given on the etiology and prevention of decay in buildings in the United States due to dry rot (*Poria incrassata* and *Merulius lacrymans*) [*R.A.M.*, viii, p. 79] under the following headings: dry rot and its causes; the factors influencing dry rot; where dry rot occurs; the prevention of dry rot; and the eradication of dry rot. Diagrams are given showing desirable and undesirable methods of construction for the support (*a*) of a wooden post on a concrete base in damp portions of a building; and (*b*) for joist bearings in masonry walls.

BARTON-WRIGHT (E. C.) & BOSWELL (J. G.). **The biochemistry of dry-rot in wood.**—*Biochem. Journ.*, xxiii, 1, pp. 110–114, 1929.

This paper opens with a short critical survey of previous work on the biochemistry of dry rot in wood, which is considered to be largely unreliable as based on colour reactions; these are unsafe since they may depend on the presence of small quantities of impurities in the tissues. It has further been assumed that the middle lamella was composed of pectin, whereas it is stated to be now known to consist largely of lignin.

Direct determinations, following in general Dore's technique (*Journ. Indus. & Engin. Chem.*, xii, pp. 472, 476, 1920), were accordingly made of the cellulose and lignin in *Picea excelsa* wood completely rotted by *Merulius lacrymans*.

An examination of the figures representing the values obtained for sound and decayed spruce (all analyses of which were calculated on ash-free material dried at 105° C.) shows a decrease of 60 per cent. in the cellulose of the rotted material and an increase of 57 per cent. in the lignin, which was further found to have undergone some modification resulting in the development of a dull brick-red colour on chlorination instead of the usual golden-yellow. The hexosans, mannan and galactan, had entirely disappeared from the decayed wood. The presence of increased amounts of uronic acids indicated that at least a part of the sodium hydroxide-soluble fraction of decayed wood consists of hemicelluloses, which were evidently, for the most part, not affected by the fungus. The yield of uronic acid from the sound wood was 2·688 per cent. as compared with 4·84 per cent. in the decayed, representing an increase of 82 per cent. in the latter. There was also an increase of 77 per cent. in the methoxyl content of the rotted wood (9·67 per cent. compared with 5·44 per cent. in the healthy wood). The hexosans

are readily hydrolysed substances and it is suggested that they are the first to be attacked, providing, with the subsequently hydrolysed cellulose, the requisite carbohydrate material for active metabolism of the fungus. It is evident from these researches that no delignification of the woody tissues takes place through the action of *M. lacrymans*.

WAI (N.). **Two new kinds of mould putrefying wooden houses in the Orient. (Abstract.)**—*Proc. Third Pan-Pacific Sci. Congr.*, Tokyo, *1926*, ii, p. 1921, 1928. [Received May, 1929.]

Brief morphological and cultural notes are given on two moulds, one isolated from the wooden wall of the author's laboratory and the second from that of a cellar; in the latter case the wall, made of sugi (*Cryptomeria japonica*) wood, was entirely decayed. The first mould [which is not named] is characterized by effuse, creeping, septate hyphae; erect, simple or branched conidiophores, 0·3 to 1 mm. in height, and spherical, single, smooth conidia, 6 to 8 μ in diameter, borne on short sterigmata, about half the diameter of the conidia. The organism converted cellulose to invert sugars, and easily decomposed sugi wood and rice straw. It formed yellow (later brown), concentric colonies on koji extract gelatine or agar. The optimum temperature for growth was 30° C.

The second mould (a species of *Penicillium*) produced two forms of conidia, one spherical and the other elliptical, the former measuring 4·4 to 6·6 μ in diameter and occurring singly, while the latter are catenulate and measure 2·2 to 2·4 by 4·4 to 5·5 μ. Its cultural characters were similar to the foregoing, except for the absence of concentric zones.

LAURITZEN (J. I.). **Rhizoctonia rot of Turnips in storage.**—*Journ. Agric. Res.*, xxxviii, 2, pp. 93–108, 1 pl., 4 graphs, 1929.

A brief description is given of a storage rot of turnips which has regularly recurred every year since 1923 at the Arlington Experiment Farm, Rosslyn, Virginia (where it caused losses varying from less than 1 to 87 per cent.), and which has also been occasionally observed in turnips and swedes on the New York and other markets. Isolations from the diseased tissues consistently yielded a species of *Rhizoctonia* morphologically similar to *R.* [*Corticium*] *solani* from potato, but differing from it in its abundant production of sclerotia on culture media and in some other macroscopical cultural characters. Since, however, comparable cultural differences were also observed in various strains of *C. solani* which were tested, the turnip organism is believed to be merely a strain of this species. In inoculation experiments [details of which are given] the strains from potato failed to infect turnips, while the pathogenicity of the turnip strain on its proper host was clearly demonstrated.

There is indirect evidence that the rot may be induced in storage from the presence of the organism in the soil clinging to the roots. Under favourable conditions infection of sound roots readily occurs through the root tips, secondary roots, and through the tops. Twelve named varieties of turnip were tested for susceptibility to

the rot, and all were found to be sufficiently susceptible to preclude the selection of any markedly resistant varieties.

In pure culture the temperature relations for growth of the fungus were: minimum about 2°, optimum about 23°, and maximum between 31·5° and 34·5° C. As indicated by infection experiments at temperatures ranging from 0·5° to 32°, the maximum, optimum, and minimum for infection and decay are 29° to 32°, 19° to 25°, and somewhere near 0°, respectively, the number of successful infections falling off rapidly below 8°. The rate of extension of the diameter of the lesions was relatively slow during the period immediately following inoculation, probably owing to the fact that some time is required to establish infection. After this period, the rate increased more or less rapidly, depending upon the temperature of the store. Within the time limits of the experiment, the rate reached a maximum by the end of the second day at temperatures between 21·5° and 29°, of the third day at 19°, of the fourth day at 15·5°, and by the end of the tenth day at 10·5°, and then declined at all these temperatures. At lower temperatures the rate of decay continued to increase until the end of the experiment.

The extent of the losses caused by this rot depend largely on the storage conditions, the main factors being humidity and temperature. High humidity favours both infection and decay. It was shown, however, that at humidities below 85 per cent. the roots tend to shrivel at all the temperatures tested. At higher humidities, up to even 90 per cent., turnips may be kept for three or four months, and over, at a temperature ranging from 0° to 2° C., without incurring heavy losses.

HIRATA (E.). **The bacterial leaf-spot of Sugar-beet.**—*Journ. Agric. Exper. Stat., Gov.-Gen. Korea*, xvii, 33 pp., 4 pl., 1928. (Japanese, with English résumé.) [Abs. in *Japanese Journ. of Botany*, iv, 3, p. (58), 1929.]

Serious damage is caused in parts of Korea by a leaf spot disease of sugar beets believed to be due to a strain of *Bacterium aptatum* [*R.A.M.*, iv, pp. 252, 469], the morphological characters of which are described in detail. An investigation was made of the cultural and physiological relations of the organism, which was found to be pathogenic to various other plants besides sugar beet. The primary sources of infection are the diseased beet seeds or tops left in the field, on which the organism overwinters. Methods of control are discussed.

STEHLIK (V.) & NEUWIRTH (F.). **Ecology of germinating Beets with respect to disease.**—*Listy Cukrovar*, xlvii, pp. 139–145, 1928. [Abs. in *Chem. Abstracts*, xxiii, 7, p. 1665, 1929.]

Phoma betae was found to be present on 97 to 100 per cent. of all beet seed, but neither this organism nor other fungi are regarded as the primary sources of beet seedling diseases. Seeds soaked in a sulphuric acid solution were not less liable to infection than those left untreated or immersed only in distilled water. Micro-organisms alone are considered to be unable to damage healthy beets, while the symptoms of disease can be experimentally induced by unfavourable growth conditions in sterile media. Thus

the fungi present in beet seedling diseases are to be considered merely as facultative parasites, the virulence of which varies with internal plant changes. The organisms attack weak beets, their virulence being increased by saprophytic evolution, or a removal of one type of organism may permit the more rapid multiplication of others. *P. betae* attacks only tissues already suffering from pathological changes, producing a toxin which enters surrounding cells by osmosis and reduces their resistance to the fungus. The carbonic acid content of the soil is another important factor in the etiology of this disease.

SAWADA (K.). **On the scientific name of red rust of Onions.**—*Rept. Nat. Hist. Soc. Formosa*, xviii, pp. 148–163, 1928. (Japanese.) [Abs. in *Japanese Journ. of Botany*, iv, 3, p. (71), 1929.]

The author's studies have led him to the conclusion that the causal organism of red rust of onions in Japan, generally known as *Puccinia porri*, should be referred to *P. allii* [*R.A.M.*, iii, p. 355].

PAPE (H.). **Der Pilz Marssonia panattoniana Berl. als Schädling des Samensalates.** [The fungus *Marssonia panattoniana* as a pest of seed Lettuce.]—*Gartenbauwissensch.*, i, p. 524, 1929. [Abs. in *Fortschr. der Landw.*, iv, 9, p. 292, 1929.]

Marssonia [*Marssonina*] *panattoniana* has been found to occur on lettuce seed-bearers as well as on the current season's plants [*R.A.M.*, iv, p. 656]. Rusty brown spots are produced on the leaves, stalks, and inflorescences. The disease is most prevalent in damp, cold, rainy weather. The spores are not carried on the seed, and it is still uncertain whether the fungus persists in any of the plant organs as resting mycelium.

TIEDJENS (V. A.). **Controlling damping-off with electric lamps.**—*Science*, N.S., lxix, 1782, p. 226, 1929.

The writer has obtained perfect control of damping-off [(?) *Pythium de Baryanum*] in highly susceptible, pure line cucumber seedlings at the Massachusetts Agricultural Experiment Station by germinating the seed under 200-watt Mazda lamps suspended 2 ft. above the seedlings. The light is concentrated by a dome reflector so that only 200 seedlings are grown under one lamp. The lamps are lighted as soon as the seed is sown and should not be turned off, except on bright, sunny days, until the seedlings are transplanted.

Legislative and administrative measures. Italy.—*Internat. Bull. of Plant Protect.*, iii, 1, pp. 22–28, 1929.

The Law of 3rd January, 1929, contains various enactments relating to plant protection and the phytopathological service in Italy. Owners of nurseries, horticultural and seed-testing establishments, all persons trading in plants, and the like, are required to obtain special permits from the Prefect of the province, in consultation with the 'Cattedrale ambulante di Agricoltura', for the exercise of their business. Only such plants and seeds shall be

released for distribution in Italy as originate from nurseries, firms, &c., having the above-mentioned special permit. Periodical inspections of nurseries and similar establishments will be made by representatives of the Ministry of National Economy or of the 'Cattedrale ambulante di Agricoltura'. Owners of nurseries and similar establishments must notify the provincial 'Cattedrale ambulante di Agricoltura' of any outbreak of diseases or pests in their plants. The functions of the representatives of the Ministry of National Economy are defined in relation to the importation and exportation of plants, inspection of imports, the compulsory formation of associations ('consorzi') of cultivators for the execution of preventive and remedial measures, and so forth.

La nuova legge per la difesa contro le malattie delle piante. [The new law for defence against plant diseases.]—*Boll. R. Staz. Pat. Veg.*, N.S., viii, 4, p. 454, 1928.

Attention is called to the fact that, as a result of recent legislation [see preceding abstract], only private growers are required to obtain an official permit for each individual consignment of plants offered for sale or transit in Italy, nurserymen being entitled to general permits covering a definite period of time if the sanitary conditions of their plantations are found, on inspection, to comply with the required standard. The issue of permits and the necessary inspections will be carried out by travelling inspectors.

Legislative and administrative measures. Ireland.—*Internat. Bull. of Plant Protect.*, iii, 1, p. 10, 1929.

The so-called Black Scab in Potatoes (Special Area) No. 2 Order, 1928, of the Government of Northern Ireland, effective as from 1st October, 1928, provides for the application to mangolds, turnips, cabbages with roots attached, and cabbage seedlings of the Black Scab [*Synchytrium endobioticum*] in Potatoes (Special Area, Ireland) Order of 1924 [cf. *R.A.M.*, v, p. 64], which refers to the movement of potatoes from the infected areas.

Legislative and administrative measures. Mauritius.—*Internat. Bull. of Plant Protect.*, iii, 1, pp. 11–12, 1929.

Proclamation No. 23 of 18th June, 1928, prohibits the importation into Mauritius, except under specified conditions, of certain plant material, including sugar-canes and cuttings thereof, all sorts of live plants together with roots, tubers, cuttings, and grafts in any kind of earth or soil, timber with the bark adhering, and tobacco seeds. The importation into Mauritius from Réunion of seeds of plants for use as green dressings is absolutely prohibited. Sugar-canes and cuttings and the living vegetable parts of any other member of the Gramineae, living plants or bulbils of *Agave* and *Fourcroya*, and tea plants may be imported under a permit from the Director of Agriculture. Sugar-canes and cuttings, live plants of all sorts and parts thereof, and fresh citrus fruits from any country except the Dependencies of Mauritius will be inspected at the port of entry before delivery.

IMPERIAL BUREAU OF MYCOLOGY

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NICOLAS (G.) & AGGÉRY (Mlle). **Une maladie bactérienne de quelques Cucumis (Cucumis melo L. et C. sativus L.).** [A bacterial disease of some species of *Cucumis* (*Cucumis melo* L. and *C. sativus* L.).]—*Rev. Path. Vég. et Ent. Agric.*, xvi, 1, pp. 39–48, 2 figs., 1929.

Melons (*Cucumis melo*) and cucumbers (*C. sativus*) growing in the vicinity of the Pyrenees are sometimes affected by a mosaic-like yellow leaf spot which is considered to be probably identical with the disease of melons described by Dufrénoy in 1921 [*R.A.M.*, i, p. 221]. Mature leaves which become affected die, while the young leaves formed after the plant is diseased remain small, misshapen, curled, and brittle; the plant develops badly, and the fruit, if any, is worthless.

Two types of bacteria, both belonging to the Coccaceae, were constantly observed in the living cells of affected plants, but no fungal mycelium was found. These organisms are Gram-negative, liquefy gelatine, cause artichoke to turn intensely green, and form white or yellow colonies on agar media. Both are ovoid, and readily stain with gentian violet; one type is 0·7 to 0·8 μ long, and the other measures 3 μ in length and is arranged in chains of not more than four cells.

Inoculation experiments on healthy melons and cucumbers gave positive results, the bacteria being subsequently observed in the affected leaves.

The constant presence of insects on affected plants is considered to indicate the mode of transmission. Contamination takes place through the young leaves, which become affected as soon as they emerge.

FAES (H.) & STAEHELIN (M.). **La lutte contre les parasites de la Vigne, insectes et champignons, en 1927 et 1928.** [The campaign against the insect and fungous parasites of the Vine in 1927 and 1928.]—*Annuaire Agric. de la Suisse*, xxx, 1, pp. 15–36, 1929.

In 1927 downy mildew of the vine [*Plasmopara viticola*] assumed alarming dimensions at the Lausanne Viticultural Experi-

ment Station from the end of June onwards. Even more destructive than the 'grey rot' phase of the disease (the term applied to attacks on the flowering bunches) was the subsequent 'brown rot' on the mature fruit during the very wet and comparatively cold months of August and September. The first application of Bordeaux mixture (2 per cent.) was given on 23rd May in order to prevent the development of the fungus subsequent to the rain on 8th and 10th May, accompanied by a temperature of 15° C. Five subsequent applications of Bordeaux mixture were given at Pully on 2nd, 13th, and 29th June, 13th July, and 5th August (2·5 per cent. for the second and 3 per cent. for succeeding ones) with satisfactory results. An adhesive consisting of 1 l. of skim milk per 100 l. of mixture was added to all the sprays [ibid., vii, p. 358]. Horst and nosperit dusts were less effective than Bordeaux mixture, except in a supplementary capacity.

In 1928 the application of an excessively alkaline Bordeaux mixture caused more or less severe damage to the leaves. On the other hand, even strongly alkaline milk of lime alone produced no such effect, showing that this ingredient plays no part in the burning. The injuries caused by excessively alkaline cupric preparations are broad, black patches on the leaf margins, while those due to extreme acidity are small, sharply delimited, dry spots with brownish edges.

Coître [*Coniothyrium diplodiella*] was the only fungus causing appreciable damage to the vines in 1928. Such were the ravages of this organism (probably owing to the abnormally high soil temperatures at the time of the hailstorms preceding the epidemic) that great anxiety prevailed among vintners and insurance companies. Experiments showed that infection is primarily caused by the precipitation of soil particles against the grapes through the action of the hail. The viability of the fungus was shown to be maintained in the laboratory for nine years [loc. cit.].

ARENS (K.). **Untersuchungen über Keimung und Zytologie der Oosporen von Plasmopara viticola (Berl. et de Toni).** [Investigations on germination and cytology of the oospores of *Plasmopara viticola* (Berl. et de Toni).]—*Jahrb. wissensch. Bot.*, lxx, 1, pp. 57–92, 16 figs., 1 graph, 1929.

Full particulars are given of the author's extensive researches on the germination and cytology of the oospores of *Plasmopara viticola*, the statistical data relating to these investigations being presented in tabular form.

The oospores are formed almost exclusively in the intercostal areas of the leaves and occur in particularly large numbers (up to 250 per sq. mm.) in small (mosaic-like) infection spots. Sometimes the oospores are distributed in narrow strips over portions of a heavily infected leaf. Probably this mode of arrangement is connected with the distribution of the mycelium in the lesions. Even the smallest veins oppose an obstacle to the passage of the hyphae which cannot immediately be overcome. As the germ-tubes of the zoospores penetrate through different stomata and in the first place permeate the underlying intercostal area, the microscopical aspect of the so-called 'oil spot' or young lesion resembles a chess-

board. Later the surrounding green areas also become occupied by the mycelium but the outer limit of the spots is always constituted by veins of varying size. The older the leaves the more difficult it is for the mycelium to traverse the veins, hence the development of the mosaic appearance in mature leaves.

Oospores develop not only in the autumn but also at a short interval after initial infection. Germination normally occurs by means of a germ-tube bearing a terminal conidium. It was shown by experiments that the germination of the oospores is accelerated as spring advances, the period required for germination being reduced from 8·8 days in material laid in the germinating bed on 21st March, 1926, to 4·4 days on 27th April and 2 days on 10th June. Germination of overwintered material was found to occur in the laboratory at any time between January and July, but attempts at the germination, in the later summer, of material kept in the open since the previous autumn were unsuccessful; it also took place occasionally in December, but very seldom in November. For some unknown reason certain individuals require a second winter in order to complete their resting period.

Germination was found to occur within a temperature range of 13° to 33° C., with an optimum at 25°. Low temperatures curtail the resting period while dry conditions prolong it and may, if protracted, injure the oospores. The primary conidia are, in all probability, conveyed to the leaves by means of spurts of rain.

The cytology of the oospores is described, and the author's results compared with those of other workers.

Arens (K.). **Physiologische Untersuchungen an Plasmopara viticola, unter besonderer Berücksichtigung der Infektionsbedingungen.** [Physiological investigations of *Plasmopara viticola*, with special reference to the conditions governing infection.]—*Jahrb. wissensch. Bot.*, lxx, 1, pp. 93–157, 10 figs., 9 diags., 1929.

All the writer's attempts at the culture of *Plasmopara viticola* on artificial media having given negative results, a very full study was made of the physiological behaviour of the fungus on its natural substratum, primarily with a view to determining the conditions governing infection and the localization of this process round the stomata [see preceding abstract].

It was found impossible to suppress the formation of the conidiophores by the exposure of the leaves to light intensities up to 1,000 candle-metres.

The germination of the sporangia may be delayed for as long as 7 days, and if kept dry their viability may be maintained for over 10 days.

The zoospores of *P. viticola* collect and germinate round the stomata of a great variety of plants belonging to a wide range of families [which are enumerated] in exactly the same way as in the case of the vine. The stimulus towards the accumulation of the zoospores round the stomata is presumably identical in the leaves of the most widely separated plants and bears no relation to susceptibility. Similar stimulatory factors to those governing infection by *P. viticola* probably operate in the case of other

parasitic fungi entering only through the stomata. It was found that oxygen is not the cause of the positive reaction towards the stomata. The width of the aperture of these organs was shown to affect the number of the zoospores settling round them, the highest percentage being found when the stomata were wide open in the full sunlight between 9 and 10·30 a.m. Heavy infection also occurs, however, during the night when the atmospheric humidity is increased, while warm rain may also promote the penetrating activity of the fungus. A positive reaction also occurs round the stomata of isolated pieces of epidermis and round those surviving in otherwise dead areas. The zoospores react positively towards OH- and P-ions and negatively to H-ions. A positive reaction was also observed towards cholesterin, lecithin, and other substances occupying an intermediate position between liquids and gases; possibly this phenomenon may be influenced by the phosphatides given off by the leaves. Free Ca-ions impede the production of phosphatides and also prevent the swarming of the zoospores round the stomata. Probably the conidia also give off surface-active substances. In immune plants, e.g. *Vitis riparia*, *Syringa vulgaris*, *Scolopendrium vulgare*, etc., the germ-tubes after penetration are unable to develop further and die of inanition after producing a more or less marked discoloration of the tissues due, probably, to the exosmosis of toxic substances.

None of the hypotheses hitherto advanced in explanation of immunity from *P. viticola* is accepted by the writer, who considers that true physiological immunity or susceptibility is based on factors which have nothing to do with purely mechanical resistance or with fluctuating chemico-physical relations.

A very full bibliography is appended.

RAVAZ (L.) & VERGE (G.). **L'excoriose.** [Excoriosis.]—*Ann. École Nat. d'Agric. Montpellier*, N.S., xix, 4, pp. 235–255, 2 col. pl., 9 figs., [1928].

This popular account of the excoriosis disease of the vine caused by *Phoma flaccida* has already been noticed from another source [*R.A.M.*, vii, p. 762].

RAVAZ (L.). **Chronique: L'excoriose. Le rougeau en 1928.** [Current events: Excoriosis. Rougeau disease in 1928.]—*Prog. Agric. et Vitic.*, xci, 4, pp. 77–83, 4 figs., 1929.

Further details are given of the increased prevalence during 1928 of the excoriosis disease of the vine [*Phoma flaccida*: *R.A.M.*, viii, p. 223, and last abstract] in France. The excessively rainy spring and the high temperatures which prevailed after vegetation had recommenced are considered to have been important factors in furthering the development of the fungus.

Notes are also given on cases of the non-parasitic rougeau disease of the vine [ibid., vii, p. 361] observed during the season of 1928, suggestions being made for the amelioration of this condition.

HOPKINS (J. C. F.). **Report of the Chief Botanist and Mycologist for the year 1928.**—*Rept. of the Secretary, Dept. of Agric., Southern Rhodesia, for the year 1928*, pp. 67–69, 1929.

During 1928, the most destructive diseases of tobacco in Rhodesia were white mould (*Erysiphe cichoracearum*), red rust (*Alternaria longipes*), frog eye (*Cercospora nicotianae*), and mosaic. Wildfire (*Bacterium tabacum*) and angular spot (*Bact. angulatum*) were widely distributed, but drought prevented them from intensive development. In some districts incipient infections of *C. nicotianae* continued to develop after the leaves were cut, and caused serious black spotting in the early stages of curing; the trouble was, however, overcome by ample ventilation of the barns at low temperatures.

The only important fruit disease of oranges was 'tear stain' associated with *Colletotrichum gloeosporioides*.

Dry rot of maize (*Diplodia zeae*) is widely distributed in Rhodesia, where it annually causes heavy losses.

Early blight (*A. solani*) was present on all potato crops and appreciably reduced the yield. Strongly growing plants resist infection two or three weeks longer than do others. *Rhizoctonia* [*Corticium*] *solani* was also general on potatoes.

The more important diseases of other crops included flax wilt (*Fusarium lini*); leaf spot (*Septoria lycopersici*) and mould (*Cladosporium fulvum*) of tomatoes; *Bact. phaseoli* on beans; *Erysiphe polygoni* on peas; *R. bataticola* [*Macrophomina phaseoli*] on eucalyptus [cf. ibid., vii, p. 619]; and *Colletotrichum theae* on tea.

[WALLACE (G. B.).] **Diseases of plants.**—*Rept. Dept. Agric. Tanganyika Territory for the year ending 31st March, 1928*, pp. 40–42, [1929.]

This report contains the following items of phytopathological interest apart from those already noticed from another source [cf. *R.A.M.*, vii, p. 630]. Brown blight of coffee (*Colletotrichum coffeanum*) was present in Tanganyika Territory at elevations below 4,000 ft.; leaf diseases of sisal [*Agave rigida sisalana*] were associated with *C. agaves*, *Botryodiplodia theobromae*, *Microdiplodia agaves*, and a species of *Helminthosporium*, while bacteria were found in the rotted bases of the leaves of *Agave* sp. Leaf parasites observed on cotton included *Pseudomonas* [*Bacterium*] *malvacearum*, *Mycosphaerella gossypina*, *Cercospora gossypina*, *Kuehneola gossypii* [*K. desmium*], a species of *Phyllosticta*, *Ramularia areola*, *Alternaria tenuis*, and *A.* sp., while a species of *Eremothecium* was found in the bolls [cf. ibid., iv, p. 148]. Other fungi found in diseased bolls at Shinyanga in 1926 were a species of *Aspergillus* (probably *A. phoenicis*), *Rhizopus nodosus* (in bolls with or without boll-worm injury), and *Nematospora gossypii*; *Diplodia gossypina* was found on the surface of the bolls. In 1927 *Monilia sitophila*, *Cladosporium herbarum*, and *A. niger* were also found in cotton bolls.

Other records include a species of *Ovulariopsis* and *Cercosporina ricinella* on castor [*Ricinus communis*], *Cercospora henningsii* on Ceara rubber [*Manihot glaziovii*]; *C. apii* on celery; *Vermicularia*

capsici, *Gloeosporium piperatum*, and *Alternaria tenuis* on chillies [*Capsicum*]; *Phomopsis* sp. on cinchona; *C. cruenta* on cowpea; *Ascochyta eriobotryae* on loquat [*Eriobotrya japonica*]; *C. neriella* on oleander [*Nerium oleander*]; *C. cucurbitae* on pumpkins [*Cucurbita* spp.]; and *Ovulariopsis papayae* on papaw.

UPPAL (B. N.). **Appendix M. Summary of the work done under the Plant Pathologist to Government, Bombay Presidency, Poona, for the year 1927-28.**—*Ann. Rept. Dept. of Agric. Bombay Presidency for the year 1927–28*, pp. 203–206, 1929.

The following references, in addition to those already noticed from other sources, are of interest in this report. Two important potato diseases in the Bombay Presidency are wilting of the plants and dry rot of the tubers. Preliminary results of an investigation of these conditions indicate that the typical dry rot can be caused by *Fusarium radicicola*, *F. coeruleum*, and a species of *Fusarium* isolated from wilted plants. The symptoms occurring in tubers inoculated with *F. trichothecioides*, *F. oxysporum*, and an unidentified *Fusarium* from a rotted tuber were less marked than, but more or less similar to, those of the early stages of dry rot [cf. *R.A.M.*, vii, p. 739].

Considerable damage is caused in the Upper Sind district by brown spot of rice (*Helminthosporium oryzae*) [ibid., viii, p. 263].

The most serious disease of chilli pepper in the Deccan and Karnatak is believed to be mosaic.

Annual Report of the Iowa Agricultural Experiment Station for fiscal year ending June 30, 1928.—64 pp., 1928. [Received May, 1929.]

This report contains the following items of phytopathological interest. An intensive study of watermelon wilt [*Fusarium niveum*] has shown that the development of resistant strains is the most promising method of control [*R.A.M.*, vii, p. 760]. None of the 40 commercial varieties of watermelon tested showed any appreciable degree of resistance, but the preserving citron, stock citron, and two African citrons proved to be highly resistant. In crosses between the resistant strains and commercial varieties, resistance appears to be recessive in the F_1 generation, while inedibility is dominant. The African citrons have also been found resistant to anthracnose [*Colletotrichum lagenarium*], which further occurs in a relatively mild form on the Thurmond's Gray commercial variety. Better results in the control of wilt were given by dusting the watermelon seeds with various proprietary and experimental preparations than by the standard mercuric chloride method of disinfection. It was found impossible to retard the appearance of the disease in the field by the use of fertilizers and chemicals or by transplanting seedlings grown in steam-sterilized soil.

Further efforts to improve the yellows- [*F. conglutinans*] resistant Iacope cabbage by self-pollination have resulted in the development of a virtually immune strain [ibid., viii, p. 157], which is also satisfactory in respect of yield, early maturity, and uniformity of type.

Stripe disease of barley [*Helminthosporium gramineum*] was very prevalent, especially in early plantings; the average incidence of infection in the Minsturdi variety grown in seed treatment plots in two localities ranged from 13 to 37 per cent. The best control was given by a dust of which the main ingredients are mercuric chloride, sodium bisulphite, and talc.

ADAMS (J. F.). **Report of the Plant Pathologist for 1928.**—*Quart. Bull. State Board of Agric., Delaware*, xix, 1, 30 pp., 13 figs., 1929.

Notes are given on numerous diseases of plants observed in Delaware during 1928, only a few of which can be mentioned.

All late apples were very severely affected by fruit spot (*Phoma pomi*); cedar rust (*Gymnosporangium juniperi-virginianae*) caused nearly 50 per cent. defoliation in several orchards; while Jonathans were heavily attacked by circular leaf spot (*Phyllosticta pirina*). *Bacterium pruni* caused severe infection of peaches and plums. A localized attack of bacterial blight (*Bact. vesicatorium*) [*R.A.M.*, viii, p. 157] was found on imported tomato plants. There was also a heavy outbreak of leaf spot (*Piricularia grisea*) [? *P. setariae*: ibid., vi, p. 637] of millet [*Setaria italica*].

REED (G. M.). **Reports on research for 1928. Plant pathology.**—*Eighteenth Ann. Rept. Brooklyn Bot. Gard., 1928* (*Brooklyn Bot. Gard. Record*, xviii, 2), pp. 52–57, 1929.

The study of the inheritance of resistance to the loose and covered oat smuts (*Ustilago avenae* and *U. levis*) was continued [*R.A.M.*, vii, p. 627]. Additional F_2 plants of Hull-less and Black Mesdag hybrids were inoculated with known strains of the smuts (117 with *U. avenae* and 178 with *U. levis*); in the former lot 23 (19·6 per cent.) contracted infection and in the latter 38 (21·3 per cent.). The Black Mesdag parent again proved highly resistant, while Hull-less showed the usual heavy incidence of infection. The results of observations on the F_4 generation of hybrids between these varieties indicated the persistence of the resistance exhibited in the preceding generations to the smut strains tested. The two hybrids between Silvermine and Black Mesdag were continued in the second and third generations, 29 additional F_2 plants being inoculated with loose smut and 26 with covered smut; in the former lot 8 plants (27·5 per cent.) contracted infection and in the latter 7 (26·9 per cent.). The data on resistance and susceptibility in the third generation are not in strict agreement with the interpretation of a single factor difference for these qualities, but they cannot be held to disprove this hypothesis [cf. ibid., viii, p. 167]. It is a mistake, however, to assume that the inheritance of resistance to both smuts necessarily proceeds on uniform lines. This is, indeed, apparently true of the crosses between Hull-less and Black Mesdag, but not of others, e.g., of those between Early Gothland and Victor or Monarch and Hull-less, where one parent is susceptible to both smuts while the other is susceptible to one only. The third and fourth generations of crosses between Early Gothland and Victor confirmed previous observations on the dominance of resistance to *U. levis*.

Second generation plants of hybrids between Early Champion and Black Mesdag oats, the former highly susceptible, and the latter very resistant to both smuts, were also grown. In the F_2, 278 plants were inoculated with loose smut and 262 with covered smut; 62 (22·3 per cent.) contracted infection in the former case and 51 (19·4 per cent.) in the latter. The resistant parent showed complete absence of infection, while the susceptible one was heavily smutted.

Some interesting data were obtained in the F_2 generation of a cross between Fulghum and Black Mesdag. The former variety is very susceptible to a definite specialized strain of *U. avenae* in the southern United States, whereas in Kansas and Missouri it is highly resistant to the local strains of this fungus. Black Mesdag is very resistant to the Fulghum strain of the smut. Of the 401 F_2 plants inoculated with this strain, 78 (19·4 per cent.) became infected, suggesting that resistance is dominant, susceptibility recessive, and segregation occurs on the basis of a three to one ratio.

One of the hybrids between Hull-less and Black Mesdag has been grown through the sixth and seventh generations; the complete resistance of the latter variety to both loose and covered smut has been maintained in the progeny.

Four strains of *Tilletia levis* and six of *T. tritici* have been differentiated by their behaviour on the Hussar, Martin, Turkey, and Kanred winter wheat varieties [ibid., vii, p. 774; viii, p. 298]. Most of these strains behaved in a more or less similar way on all the spring wheats used in the tests, but strain 6 of *T. tritici* proved exceptional in this respect; it was innocuous to several varieties, including Garnet, Hope, Kitchener, Ruby, Kota, Marquis, and Florence, while the highest infection occurred on Red Sask (70·8 per cent.). The nine remaining strains produced high percentages of infection (80 to 100) on most varieties. The semi-resistant Marquis and Florence varieties showed, respectively, 33·3 to 62·9 and 18·7 to 53·8 per cent. infection with the four strains of *T. levis*, and 51·7 to 89·2 and 11·7 to 66·6, respectively, with *T. tritici*. Only one variety, Hope (originating in North Dakota), proved resistant to all ten strains of wheat bunt.

STAHEL [G.]. **Witch broom.**—*Proc. Agric. Soc. Trinidad and Tobago*, xxix, 1, pp. 12–19, 1929.

This paper (given originally as a lecture) on the witches' broom disease of cacao (*Marasmius perniciosus*) in Trinidad contains the following items of interest other than those previously noticed from another source [*R.A.M.*, viii, p. 161].

In the two areas concerned about 60 per cent. (or 37,000) of the trees were affected at the first inspection, this figure being reduced by the control measures subsequently adopted to from 3 to 4 per cent. These trees had evidently been diseased for some years. The drier climate of Trinidad accounts for the fact that the hardening of the pods that is one of the effects of the disease is less there, even when no preventive measures are taken, than in Dutch Guiana.

The author asserts his conviction that even with the very careful

control methods now practised the disease will slowly spread all over the island.

The fructifications of *M. perniciosus* seen in Trinidad are identical with those found in British and Dutch Guiana, but are paler and less robust than those observed in Ecuador.

In the author's opinion the control methods adopted by the Department of Agriculture [ibid., viii, p. 432] are entirely satisfactory.

BECKER (J.). **Untersuchung über die Lebensfähigkeit von Uredosporen von Puccinia glumarum.** [Investigation on the viability of uredospores of *Puccinia glumarum*.]—*Kühn-Arch.*, xix, p. 353, 1928. [Abs. in *Fortschr. der Landw.*, iv, p. 329, 1929.]

In a study of the factors governing the viability of the uredospores of yellow rust of wheat and barley (*Puccinia glumarum*), the writer found that the optimum temperature for the retention of germinability in this species is 0° C. at a relative atmospheric humidity of 40 per cent. [*R.A.M.*, viii, pp. 163, 361]. Under these conditions a proportion of the spores germinated after 433 days. The viability of *P. glumarum* declined rapidly with a rising temperature and increasing humidity. The optimum temperature for the maintenance of viability in *P. triticina* from wheat was found to be 0° to 5°, with a relative humidity of 50 to 60 per cent. The best germination results were given by the uredospores of *P. glumarum* which developed first and matured normally, those formed later behaving in the erratic manner characteristic of this rust.

MEHTA (K. C.). **The annual recurrence of rusts on Wheat in India.**—*Sixteenth Indian Science Congress* (*Section of Botany*), Madras, *1929*, 25 pp., 1929.

A full account is given of the author's researches in India, covering a period of over five years, on the incidence of the black, brown, and yellow rusts of wheat (*Puccinia graminis*, *P. triticina*, and *P. glumarum*), chiefly in the United Provinces of Agra and Oudh, as well as in parts of the Kumaon and Simla regions of the Himalaya.

It appears to be almost impossible for the uredospores to survive the intense summer heat in the plains of the greater part of India, where a maximum shade temperature of 110° F. may prevail for several weeks. Self-sown cereals are practically absent during the summer and rust has not been found on them or on wild grass hosts during this period. Thus, during the sowing of the wheat crop (from the last week of October till the middle of November), no local source of infection is generally available in the plains, where no species of barberry can live. Though experiments have shown that the weather conditions are favourable for infection in the second half of October and during November, the incubation period then being only 7 to 10 days, still rusts on this crop do not ordinarily appear before the latter part of January in the plains of the United Provinces, and the early infections do not develop from the base to the apex of the plant, but a leaf here and there shows sori irregularly situated. That

the uredospores do not survive in the soil is shown by the fact that the plants remain free from infection in fields that bore severely rusted crops the previous season for the first two or three months of their growth. In the hills, however, where the summer is comparatively cool and barberries grow freely, viable uredospores of the brown and yellow rusts have been observed on self-sown plants and tillers, e. g., near Muktesar (7,600 ft. above sea-level) several times in September and October.

Following successful infection of the new crop in the hills by yellow rust, in late October or early November, comes a somewhat lengthy incubation period, and the uredo stage does not usually appear in the hills before the end of January. Probably the uredospores are then conveyed by the wind from Muktesar and other places in similar situations to the crops in the plains. The crops at the foot of the Kumaon hills have constantly been observed to show infection a week or two earlier than those at a greater distance, and the early intensity of attack is greater. In a general way, the results of these investigations on the incidence of rusts in the hills present a close analogy with those obtained at Cambridge [*R.A.M.*, iii, p. 20].

No connexion has yet been proved between the brown and black rusts and their suspected alternate hosts, *Thalictrum javanicum* and *Berberis aristata*, respectively. However, the occurrence of *P. graminis* on wheat near Simla and Bhimtal in close proximity to infected barberry bushes suggests a similar relation to that known to exist in Europe and the United States. The aecidial stage of *P. triticina* on *T. javanicum* is reported to occur during July to August and that of *P. graminis* on *B. aristata* in August. It is evident, therefore, that this stage is of no importance in the infection of the wheat crops in the plain, where the brown rust ordinarily appears early in February and the black a little later. Possibly, however, the aecidial stage may play a part in the infection of self-sown wheat plants in the hills during July and August, and may account for the viable uredospores found by the author on volunteer and stubble wheat tillers, these surviving till the new crop is sown in October to November. The onset of the cold weather then delays the incubation period of the rusts. At Muktesar and similar altitudes, where the winter is severe and accompanied by snow, both the uredospores and the mycelium within the host are probably killed. *P. graminis*, at any rate, cannot survive the winter at this height. However, at somewhat lower altitudes both the uredospores and the mycelium may survive the early part of the winter and produce early outbreaks in December and January.

The data obtained in these studies clearly indicate that the source of danger to Indian wheat crops lies in the hills, and that further investigations on the problem of control are urgently needed. The eradication of the rusts should be greatly facilitated by the established absence of local sources of infection in the plains during the sowing of the crop. It is evident, moreover, that self-sown plants and tillers should be destroyed after harvest in the hills, while an even more effective control measure would be the suspension of wheat cultivation for two or three years at altitudes where the uredospores of the rusts can survive the summer heat.

JOHNSTON (C. O.) & MELCHERS (L. E.). **Greenhouse studies on the relation of age of Wheat plants to infection by Puccinia triticina.**—*Journ. Agric. Res.*, xxxviii, 3, pp. 147–157, 3 pl., 1929.

Details are given of greenhouse experiments which were carried out during the winters of 1925–6 and 1926–7 at the Kansas Agricultural Experiment Station to ascertain the variations in reaction of a number of varieties of wheat to leaf rust (*Puccinia triticina*) at different stages of growth. Physiological form IX [*R.A.M.*, viii, p. 427, and next abstract] was used in the tests because of its wide prevalence in the southern Great Plains area, and also for the reason that certain wheat varieties had been found to be resistant to it in the field and susceptible in the greenhouse. The wheat plants were inoculated at three stages of growth, namely: the seedling stage (about a month after sowing, when the plants had five to seven leaves and while the primary leaf was still green); the shooting stage (after the plants had passed the stage of very slow development which, in the greenhouse, is comparable to the winter period of dormancy in the field); and the heading stage, when the head emerged from the sheath, or appoximately one month before ripening. Notes on the development of the rust were taken on all the plants 14 to 16 days after inoculation.

The results (which are given in tabular form) showed that certain varieties of wheat, very susceptible to the rust studied in the seedling stage, exhibited high resistance at heading time, while others changed very slightly or not at all in their reaction to the rust. Malakoff, Bacska, Sibley, Banat, Brown Bearded, and P721 were susceptible in all stages of growth, though some were slightly less so at heading time. All the varieties tested which were resistant to, or immune from, the rust in the seedling stage, retained this character throughout their life.

The varieties of wheat which varied with age in their reaction to the rust exhibited the highest degree of resistance in their uppermost leaves, while the leaves ranging downwards from the top became more susceptible until the lowermost sometimes bore numerous infections. The majority of these varieties also showed considerable resistance in the field. Similar changes in susceptibility were also noted in many hybrid plants and selections, particularly in hybrids heterozygous for reaction to rust. It is pointed out that promising new varieties, strains, and hybrids may be discarded if they are tested only at the seedling stage.

The phenomenon of increasing resistance to leaf rust with age (which is interpreted by the authors as latent resistance) [cf. ibid., viii, p. 363] was observed in widely diverse types of wheat, including the most important types of the common bread wheats.

JOHNSTON (C. O.). **The occurrence of strains resistant to leaf rust in certain varieties of Wheat.**—*Journ. Amer. Soc. Agron.*, xxi, 5, pp. 568–573, 1929.

Of some 200 varieties of wheat tested under greenhouse conditions at Manhattan, Kansas, for reaction to leaf rust (*Puccinia triticina*,

physiological form IX) [see preceding abstract] from 1921 to 1926, 28 were found to contain resistant strains, most of which resembled the parent varieties in general morphological characters. Most of the varieties in which the resistant strains occurred were soft red winter wheats, including Mediterranean No. 31, Kawvale, Diehl-Mediterranean, Illini Chief, Silversheaf, Kansan, Fulcaster, Currell, and Evans. These studies have shown that selection within a variety is often a useful method of rapidly obtaining wheat strains resistant to a single physiological form of leaf rust.

SANFORD (G. B.) & BROADFOOT (W. C.). **Stripe rust in Alberta.**—*Scient. Agric.*, ix, 6, pp. 337–345, 1 fig., 1 map, 1929.

The results of an investigation made in Alberta in 1928 showed that stripe rust (*Puccinia glumarum*) was widely distributed on wild barley (*Hordeum jubatum*) over the whole area extending from the foot hills of the Rocky Mountains in the west to the Saskatchewan boundary in the east, and from the Grande Prairie and Pouce Coupé districts of the Peace River area in the north to the Lethbridge district in the south. On this host the rust appeared to increase gradually in intensity as the season advanced, until the onset of frosts in the autumn, which checked vegetation. Records of the rust were also made on common barley (*H. vulgare*), wheat (*Triticum vulgare* and *T. durum*), *Agropyron smithii*, and *A. dasystachyum* [cf. *R.A.M.*, vii, p. 568; viii, p. 360].

A partial explanation of the reason why, so far, stripe rust has not become a serious menace in Western Canada was given by the results of resistance tests made in 1928 at the Provincial School of Agriculture, Olds, with 64 of the varieties of spring wheat most commonly grown in Alberta, all of which, with the exception of Chagot (which was severely attacked), proved to be entirely resistant or only slightly susceptible to the prevailing strains of the rust.

That stripe rust can overwinter on wheat under winter conditions of average severity in Canada was shown by the fact that in May, 1928, it was found to be fairly plentiful on the first, second, and third leaves of winter-sown wheat plants (Kharkov M. C. 22) on the experimental plots of the Provincial School of Agriculture, Claresholm. The spores collected from the infected leaves gave a high percentage of germination. It is not thought probable that, under normal conditions, the rust overwinters on wild grasses.

WIESSELL (K.). **Trockenbeizanlage.** [Dusting apparatus.]—*Deutsche Landw. Presse*, lvi, 5, p. 68, 4 figs., 1929.

By means of a special contrivance [details of which are given] the writer has succeeded in augmenting the efficiency of the Lothrä dusting apparatus and reducing the labour connected with seed-grain disinfection to a minimum. The improvement is based on the installation of down pipes through which the seed-grain is passed direct from the granary to the drum.

LUNDEGÅRDH (H.). **Utsädesbetning. De vid Centralanstaltens Botaniska avdelning pågående undersökningarna.** [Seed disinfection. The investigations proceeding at the Botanical Department of the Central Institute.]—*Landtmannen*, xii, 6, pp. 115–116, 1929.

After a brief discussion of the problems awaiting solution in connexion with seed disinfection in Sweden, the writer describes a series of investigations recently undertaken to ascertain the effects of various environmental factors on this process.

It was found that the incidence of infection by *Fusarium* spp. and other foot- and root-rotting fungi prevalent on cereal seedlings declined with a rising temperature, e. g., from 35·7 per cent. at 10° C. to 13·92 per cent. at 20° on Norrland rye, and from 79·15 per cent. at 10° to 44·21 per cent. at 20° for Extra Kolben II wheat. The testing of disinfectants, therefore, should take place at a relatively low temperature (10° to 15° at the highest); above 20° their efficacy is less evident and at 25° to 30° they may exert a more or less toxic action on the seed-grain [cf. *R.A.M.*, v, p. 540]. At 10° a high soil moisture content (64 to 82 per cent.) was found to increase the incidence of infection, whereas at 30° the reverse is the case. Experiments have shown that the most uniform and reliable results are obtained where the soil moisture content is maintained above 60 per cent. at a low temperature.

Another important factor in the development of infection is the distance between the seedlings. In tests with 20 and 50 seeds, respectively, per tray of 100 sq. cm., infection was heavier in the denser sowings. Thus, in Norrland rye the proportion of healthy seedlings decreased from 84·69 to 64·3 per cent. at 10° under these conditions, while in Extra Kolben II there was a decline from 33·33 to 14·38 per cent. Greater uniformity was secured in the tests conducted on an ordinary mixed sand and compost soil than where brick dust or sterilized soil were used.

Investigations are now in progress on the toxicity of inorganic chlorides and nitrates, and of organic water-soluble substances towards *Tilletia* [*tritici* and *T. levis*] and also towards wheat seed-grain. It has been ascertained that the toxic action on the seed of fungicides used at excessively high concentrations is due, in part, to a retardation of growth which facilitates infection.

LINDFORS (T.). **Några erinringar om betning av vårutsädet.** [A few reminders concerning the disinfection of spring seed-grain.]—*Landtmannen*, xii, 8, pp. 154–155, 1 fig., 1929.

Directions are given in popular terms for the disinfection of spring cereal seed-grain against a number of fungous diseases by various standard methods [*R.A.M.*, vi, p. 476 *et passim*].

DILLON WESTON (W. A. R.). **The control of 'bunt' in Wheat.**—*Ann. of Appl. Biol.*, xvi, 1, pp. 86–92, 1929.

In this brief note the author discusses the results obtained at the Cambridge University Farm in experiments made during four consecutive years to test the relative efficacy of the control of wheat bunt [*Tilletia tritici*] by steeping the seed-grain in copper

sulphate or formaldehyde solutions, and by dusting it with copper carbonate [cf. *R.A.M.*, viii. p. 368]. Formaldehyde at the strength recommended by the Ministry of Agriculture (1 in 320) proved both safe and economical, and gave almost absolute control of the disease, while 2·5 per cent. copper sulphate slightly affected the germinability of the seed-grain and only gave relative control. The efficacy of dusting the seed-grain with copper carbonate in doses from 3 to 9 oz. per bushel was shown to vary with the spore load, being directly proportional to the rate of contamination; with the usual, only slightly, contaminated commercial samples of seed-grain, the treatment gave effective control. Although the cost of dusting with copper carbonate is at least twice that of the others, its great advantage is its convenience, as it enables the seedsmen to send out already treated seed.

Feeding experiments with treated wheat showed that, for short periods at least, it may be safely fed to poultry.

FINNELL (H. H.). **Relations of grazing to Wheat smut and tillering.**—*Journ. Amer. Soc. Agron.*, xxi, 3, pp. 367–374, 1929.

Observations have been made at Goodwell, Oklahoma, on the effects of seed-bed conditions and grazing on the amount of wheat bunt [*Tilletia levis*] and the tillering of healthy and diseased plants.

Tillering was not affected, either in healthy or diseased plants, by excessive seed-bed moisture, but the percentage of bunted plants was higher than when germination took place in less moist soils. Grazing in the early spring growth stage (1st April) caused a decrease in the number of ears formed by infected plants. The percentage of bunted ears and also the number of ears borne by each infected plant were reduced by later grazing.

Apparently, therefore, infected wheat plants do not possess sufficient recuperative power to form new tillers in place of those that have been destroyed, and in extreme cases no ears at all may be produced.

TRELEASE (S. F.) & TRELEASE (HELEN M.). **Susceptibility of Wheat to mildew as influenced by carbohydrate supply.**—*Bull. Torrey Bot. Club*, lvi, 2, pp. 65–92, 1929.

The investigation described in some detail in this paper was made in continuation of the authors' study of the action exerted by environmental conditions on the susceptibility of plants to fungous diseases [*R.A.M.*, vii, p. 437]. The purpose of the experiments was to test the effect of quantitative and qualitative variations in the supply of carbohydrates on the susceptibility of wheat to mildew (*Erysiphe graminis*), in order to supplement the information already in existence [a brief review of which is given] concerning this relationship in other parasitic diseases. The plants tested were seedlings of Leap's Prolific winter wheat, grown in a shaded greenhouse and placed in the dark for various lengths of time after inoculation.

No development of *Oidium* spores occurred on the inoculated seedlings that were kept in the dark for seven days or longer; such plants were greatly dwarfed, extremely chlorotic, and died in

a few days after being returned to the light. After four days in the dark, numerous light yellow flecks appeared on the inoculated leaves, indicating initial infection, but spores failed to develop. This result is interpreted as showing that wheat plants must be exposed to light to render them susceptible to mildew under normal conditions. The incubation period was only slightly increased by a stay of one or two days in the dark, but if kept for three to six days the incubation period was lengthened by one to four days, respectively, i. e., by about two days less than the period spent in darkness. The wheat seedlings appeared to be injured more rapidly by darkness than by the mildew, since they were unable to survive a stay of seven days in the dark, while they are usually able to live two or three weeks with the most severe infection possible with mildew, if other conditions are favourable to them. Uninoculated seedlings kept for three days in darkness prior to inoculation failed to develop the mildew when returned to the dark room immediately after inoculation, but spores appeared in 3·5 days on similar seedlings that were allowed to remain in the lighted greenhouse for two days before removal to darkness. Very young seedlings (four days old), which were still receiving a supply of food from the endosperm, were slightly susceptible to mildew in the dark.

Further experiments showed that conidia developed abundantly in the dark on cut leaves of inoculated seedlings, when the leaves were supplied with a solution containing any one of many carbohydrates [a list of which is given], or with a solution containing glycerine or mannite, while very few conidia appeared on similar leaves supplied with tap water containing no carbohydrate. The fact that mildew developed in the dark as readily on etiolated as on green leaves, when a carbohydrate or glycerine was supplied to them, is believed to indicate that chlorophyll is not necessary for the development of the fungus. The addition of nutrient salts to the carbohydrate or glycerine solutions did not appreciably modify the efficacy of the latter in rendering the leaves susceptible to mildew. The efficacy in this respect of solutions of sucrose, dextrose, and glycerine appears to be directly related to the carbon concentration of the solution, since the susceptibility of the leaves increased with an increase of concentration, until a limit was reached which is apparently dependent on the osmotic properties of the solution, this limit being about 19 atmospheres for each of the three substances.

The results of this investigation are interpreted as showing that susceptibility to the strain of mildew studied was promoted by conditions which led to the accumulation in the leaves of a surplus of carbohydrate largely in excess of that which is required for the life processes of the host. Under the conditions of the tests, the susceptibility appeared to be proportional to the carbohydrate content of the epidermal cells, which is determined by a complex set of internal and external conditions, a summarized outline of which is given.

The development of the mildew was apparently strictly limited by the life of the host, since no tendency was observed in the experiments for the mycelium to spread in the carbohydrate

solutions beyond the leaves. There was also evidence that the development of the parasite is dependent on the continuance of the host's metabolism. There was no indication that starvation of the host favours the development of mildew. The general conclusion is that conditions which tend to favour the life processes of the wheat plant increase its susceptibility to the disease.

Field tests made during the summer in full sunlight and under deep shade of trees on the grounds of Columbia University, New York, showed that inoculated plants kept in the shade always became heavily infected with mildew, while those in the sunlight usually showed only a slight flecking of the epidermis and no development of spore tufts. These results confirm the general observations made by previous workers on the relative susceptibility of wheat to *E. graminis* in direct sunlight and in diffused light, and are believed to be due to the action of intense light in inhibiting the pathogenicity of the parasite, or to a drying effect on the fungus.

NISIKADO (Y.). **Preliminary notes on yellow spot disease of Wheat caused by Helminthosporium tritici-vulgaris Nisikado.**—*Ber. Ōhara Inst. Landw. Forsch.*, iv, 1, pp. 103–109, 2 pl., 1929.

This is an English translation of the writer's Japanese paper published in *Ann. Phytopath. Soc. Japan*, ii, p. 89, 1928, an abstract of which has already appeared [*R.A.M.*, viii, p. 164].

CHRISTENSEN (J. J.). **The influence of temperature on the frequency of mutation in Helminthosporium sativum.**—*Phytopath.*, xix, 2, pp. 155–162, 3 figs., 1 graph, 1929.

A study was made, under controlled conditions, of the effect of temperature on the frequency of mutation in various physiological forms of the cereal parasite *Helminthosporium sativum* [*R.A.M.*, vi, p. 473] grown on Difco cornmeal-potato-dextrose-agar.

Temperature was found to exert a very marked action on the frequency of mutation, the optimum temperature for which in *H. sativum* lies in the vicinity of 25° to 27° C. No mutation occurred in cultures grown at 15° or below, and relatively little at temperatures below 25° or above 30°.

Most of the mutants of *H. sativum* that developed in the course of these experiments have remained stable both as to cultural and pathogenic characters for four years, but a few instances of reversion to the parental type of culture have been noted. Only in one case did the passage of mutants through living hosts induce any modification of cultural characters. These data are considered to support the view that sectors are usually true mutants and not mere phenotypic changes.

TU (C.). **Physiologic specialization in Fusarium spp. causing head blight of small grains.**—*Phytopath.*, xix, 2, pp. 143–154, 3 figs., 1929.

The results of the author's preliminary comparative study carried out at St. Paul, Minnesota, during 1927 and 1928, on the relative virulence of the different species of *Fusarium* causing

head blight of cereals in the United States are tabulated and discussed [*R.A.M.*, viii, p. 371]. The following material was used in the investigations in 1927: three cultures of *Gibberella saubinetii* [ibid., vii, p. 570] (two from wheat and one from oats) and three of *F. culmorum* from wheat [ibid., vii, p. 710].

On the basis of their pathogenicity towards differential hosts (seven varieties of wheat and Minsturdi barley), three physiological forms of *G. saubinetii* and three of *F. culmorum* were distinguished. In 1927 the most severe infection of Minsturdi barley was produced by *F. culmorum* form 1 (94·5 per cent.), *F. culmorum* form 2 and *G. saubinetii* form 1 coming next in virulence (79·5 and 78·6 per cent., respectively). The incidence of head blight on wheat was much lower than on barley, the heaviest attack being caused by *G. saubinetii* form 1 on the Ceres variety (44·3 per cent.). On all the varieties of wheat except Kota, *G. saubinetii* form 1 was more virulent than any of the other cultures; Kota proved most susceptible to *F. culmorum* form 3 (16·2 per cent. infection compared with 1·6 by *G. saubinetii*).

In 1928, when more extensive tests were made including *F. nivale* (*Calonectria graminicola*) from rye (Germany), *F. solani* and two forms of *F. avenaceum* from wheat, and a mutant of *F. culmorum* form 1, while a second barley variety, Glabron, and two varieties of oats were added, the relative virulence of the physiological forms of *F. culmorum* and *G. saubinetii* on barley and wheat remained practically the same as in 1927, except that wheat was more heavily infected, probably owing to the dull, rainy weather following flowering. The most virulent attack on oats was caused by *G. saubinetii* form 3 (78 and 80 per cent., respectively, on the Victory and Anthony varieties), but *F. culmorum* forms 1 and 3 were nearly as virulent. On all the varieties of wheat, barley, and oats tested, except the durum wheats, *F. avenaceum* form 2 was consistently more virulent than form 1 of this species, the former producing 27·2 per cent. infection on Mindum wheat and 26·5 per cent. on Akrona, while the corresponding figures for the latter were only 15·4 and 16·4 per cent., respectively. *F. solani* and *C. graminicola* were most virulent on Glabron barley (61·6 and 62·4 per cent. head blight, respectively), while Anthony oats were also fairly severely attacked (46·1 per cent. infection by *F. solani* and 54·2 per cent. by *C. graminicola*).

Mutation occurred in *F. culmorum* form 1 at 27° C. on Difco potato dextrose agar, the mutant producing fewer spores and exhibiting considerably less virulence than its parent in the causation of head blight. *F. avenaceum* form 2, the three physiological forms of *G. saubinetii*, and those of *F. culmorum* (with its mutant) made the best growth at 27°. The optimum temperature for the development of *F. avenaceum* form 1 and *C. graminicola* was found to be 22°, while *F. solani* grew best at 32°.

BABOWITZ (K.). **Ratgeber zur Sortenwahl. Vierjährige Sorten-Vorprüfungsergebnisse mit Sommergersten für schweren Boden. Versuchsjahre 1924–1927. Teil viii.** [Advice on varietal selection. Results of four years' preliminary varietal

tests with summer Barleys for heavy soil. Experimental years 1924–1927. Part viii.]—*Arb. Deutsch. Landw. Gesellsch.*, 366, 59 pp., 1929.

This report contains the following note of phytopathological interest. Loose smut of barley [*Ustilago nuda*] was observed chiefly on the Görsdorfer D, Rimpau's Hanna, Rud. Bethge's II and III, and Stadler's R. 40 varieties, while Pflug's Intensiv, Ackermann's Bavaria, Zeiner's Franken F. 10, and Zeiner's Franken St. Z proved susceptible to stripe disease [*Helminthosporium gramineum*].

SAMPSON (KATHLEEN). **The biology of Oat smuts. II. Varietal resistance.**—*Ann. of Appl. Biol.*, xvi, 1, pp. 65–85, 1 pl., 1 graph, 1929.

Continuing her study of the biology of the oat smuts, *Ustilago avenae* and *U. levis* [*R.A.M.*, viii, p. 372], the author gives details of experiments in Wales from 1926 to 1928 to test the biological specialization of a number of spore collections of both species. The results showed the existence, besides the four biological strains of *U. avenae* and two strains of *U. levis* already described by her and by Reed [ibid., vi, p. 156], of one other strain of the former which is only able to attack varieties of *Avena brevis* and *A. strigosa*, and one strain of *U. levis* which shows a decided similarity to the Missouri strain first studied by Reed [ibid., iv, p. 27] but differs from it in its low infective capacity on *A. strigosa orcadensis* and *A. nuda*.

A large number of samples of commercial oats were grown in 1927, but not a single sample of *A. sativa* showed any infection by *U. levis*, a result which confirms the view of the rare occurrence in Great Britain of strains of this species capable of attacking *sativa* varieties. Both smuts appeared most frequently on varieties belonging to the Winter, Potato, or Sprig groups, which were also among the most susceptible of those tested experimentally with the Welsh strain of *U. avenae* isolated originally from Potato oats; it is thought probable that this biological strain is widely distributed in the British Isles. Different pure lines of *A. strigosa* varied in their resistance to the Welsh strain of *U. levis* from 0 (over 90 per cent. successfully inoculated) to 100 (none successfully inoculated). Details are given of the infective capacities of four strains of *U. avenae* and three of *U. levis* on several species and varieties of oats. The *A. sativa* variety Markton remained immune from all seven strains, thus confirming its behaviour in the United States [ibid., v, p. 290].

Examination of the pales of grain from samples which gave over 10 per cent. smut infection showed the presence of abundant resting mycelium of *U. avenae*, indicating the general occurrence of 'flowering infection' as described by Zade [ibid., ii, p. 214]. The extent to which oat varieties open their pales, and the atmospheric conditions during and shortly after the flowering period, are evidently important factors in determining the intensity of smut attack in the subsequent crop; varieties giving high infection figures under experimental conditions are not necessarily highly susceptible in the field.

A description is also given of the different methods employed for testing varieties of oats for resistance to smut, among which a technique involving the germination of shelled grain in sand of low moisture content at a temperature of 22° C. gave the most satisfactory results.

CHURCHILL (B. R.). **Oat rust damage severe in Upper Peninsula. Development of immune varieties of Oats appears promising.** —*Quart. Bull. Michigan Agric. Exper. Stat.*, xi, 3, pp. 111–115, 1929.

Heavy damage was caused by stem and crown rust of oats [*Puccinia graminis* and *P. lolii*] in the Upper Peninsula of Michigan during 1926 and 1927 [cf. *R.A.M.*, viii, p. 167]. The application of superphosphate (150 to 200 lb. per acre at sowing time) has been found to expedite the maturity of the crop by seven to ten days, thereby affording it an opportunity to escape infection. The results [which are tabulated] of five years' experiments, from 1924 to 1928, inclusive, show that the most rust-resistant varieties (0 to 5 per cent. infection) are those of the Kherson type, Richland, Iogold, Iowa 444, and Selection 459-14-3. Fair resistance (6 to 15 per cent.) was shown by White Russian, Anthony, and Minota × White Russian. The moderately susceptible group (16 to 30 per cent.) is represented mainly by the red or *sterilis* type of oats, but two selections of Kherson also fall into this category, which includes Joanette, Iowar, Fulghum, Burt, Rustless, Green Mountain, Gopher, and Kanota. A high degree of susceptibility was shown by Iogren, Ruakura, Red Rustproof, Swedish Select, Silvermine, Wolverine, and Markton.

HORSFALL (J. G.). **Dusting seed for Oat smuts.**—*Phytopath.*, xix, 2, pp. 173–175, 1929.

A brief account, accompanied by a table, is given of the writer's recent experiments at Cornell University in the control of the loose and covered smuts of oats [*Ustilago avenae* and *U. levis*] with thirteen different disinfectant dusts. Both smuts were satisfactorily controlled by Du Pont KIC and KIB and Grasselli smuttox (4 per cent. formaldehyde in infusorial earth) [*R.A.M.*, vii, p. 159]. Bayer dust 200 was slightly less effective than the foregoing; Bayer 197, 196, 195, 194, 193, and 192 and Du Pont 68 were intermediate; while Bayer 189 failed to give adequate control. All the dusts were applied at the rate of 3 oz. per bushel.

CALMA (V. C.), PADERNA (L. G.), & PALO (M. A.). **A study of certain chemical treatments in relation to seed-borne diseases of Calauan Yellow Flint Maize.**—*Philipp. Agric.*, xvii, 9, pp. 499–506, 1929.

The writers describe and tabulate the results of their experiments, extending from October, 1924, to January, 1926, and from October, 1926, to February, 1928, in the control of seed-borne fungi on Calauan Yellow Flint maize at Los Baños, Philippine Islands.

Fusarium sp. and a black mould were found to be the predominant organisms in the maize kernels, while a yellow and a blue mould were also present to a lesser extent. The fungi [which were

not more closely identified] are carried on the seed-coat and in the endosperm and embryo of the kernels.

Good results in the elimination of these organisms, and consequently in the increased production of ears, were given by immersion in 0·25 per cent. germisan for $8\frac{1}{2}$ hours. Uspulun (0·5 per cent., 4 to $4\frac{1}{2}$ hours' immersion, or 0·75 per cent., 3 hours) and semesan (0·5 and 0·75 per cent., $2\frac{1}{2}$ to $3\frac{1}{2}$ hours) were also beneficial. Formalin (0·1 per cent. for 7 hours or 0·2 per cent. for 5 hours) and mercuric chloride (0·01 per cent. for 5 hours and 0·02 per cent. for $4\frac{1}{2}$ hours) were only moderately effective, and the various dust treatments unsatisfactory.

Owing to their almost prohibitive cost, and to their extreme toxicity to man and animals, the above-mentioned chemicals are not likely to find a wide application to the Philippines, but they are considered to merit further testing for technical purposes.

HOPKINS (J. C. F.). **Investigations into 'collar-rot' disease of Citrus.**—*Rhodesia Agric. Journ.*, xxvi, 2, pp. 137–146, 8 figs., 1929.

A full account is given in popular terms of three obscure diseases of citrus, chiefly Washington navel oranges, in Rhodesia. One of these conditions is characterized by a yellowing of the leaves and withering of the twigs, which in turn causes cracking of the bark and die-back of the branches, with the subsequent death of the tree. A careful examination of some 200 trees so affected revealed black lines and incrustations on the bark and wood of the roots, closely resembling those described by Small and attributed by him to *Rhizoctonia lamellifera* [*R. bataticola*: *R.A.M.*, iii, p. 748; v, p. 451] on *Grevillea robusta* in Uganda. Isolations were made from numerous pieces of material and *R. bataticola* was invariably obtained.

In addition to these symptoms, the more unhealthy trees also showed a collar rot differing from that found on citrus in America in that usually there was no external exudation of gum, and the bark was cracked only above the bud union. This condition was found to be due to the deposition of gum in the outer regions of the woody cylinder, following the interference with the functioning of the roots caused by *R. bataticola*. That the trees reacted to the fungal invasion by the production of gum was indicated by the fact that the infected wood was always bounded by a layer of gum, and in the early stages of the disease gum was found clogging the root vessels in advance of the invading organism.

Two other types of collar rot, caused, respectively, by water-logging and excessively deep planting, are also described. In the former, the external symptoms resembled those described above. The latter type appears to be more closely related than the other two to the American form of collar rot; the diseased area, which is darker than in either of the other Rhodesian forms, often extends below the bud union. *Botryodiplodia theobromae* was usually present in all three types of collar rot as a secondary organism.

Brief suggestions are made for the control of these diseases by inarching, root pruning, disinfection, aeration, and improved drainage.

BENLLOCH (M.). **Informes sobre el estado sanitario de los cultivos en el año 1928.** [Notes on the health of cultivated plants during the year 1928.]—*Estac. Centr. Fitopat. Agric.*, Madrid, 83 pp., 1929.

This report is mainly entomological but contains a few scattered references to fungous diseases. Oranges in the narrow valleys and ravines of Hornachos (Badajoz) were attacked by anthracnose (*Colletotrichum gloeosporioides*) [the symptoms of which are briefly described in popular terms]. Control measures should include the addition to the soil of gypsum at the rate of 8 to 10 kg. per plant in order to modify the alkaline reaction (P_H 7·3); repeated applications to the trees of 1 or 2 per cent. Bordeaux mixture; the use of a fertilizer consisting of 50 per cent. superphosphate, 35 per cent. ammonium sulphate, and 15 per cent. potassium sulphate (to be given in March at the rate of 1,200 kg. per hect.); and the usual cultural measures.

TAUBENHAUS (J. J.), EZEKIEL (W. N.), & REA (H. E.). **A new Cotton wilt.**—*Phytopath.*, xix, 2, pp. 171–173, 1 fig., 1929.

A severe wilt disease of cotton, apparently distinct from that caused by *Fusarium vasinfectum* [*R.A.M.*, viii, p. 101], has been reported from three widely separated counties of Texas, especially from Ellis County.

Affected plants are stunted and peculiarly branched, with abnormally short, stout joints; in advanced stages of the disease the plants shed their leaves and the branches become dull in colour. In some cases the plants die from the tops and new growth appears on the lower part of the main stem. Only a few of the diseased individuals are able to produce one or two bolls of cotton. Occasionally the dwarfing and stunting of infected plants is so marked as to give the impression of a rosette. The new disease may be differentiated from *Fusarium* wilt by the splitting of the stems and by the black discoloration of the interior cylinder of both roots and stems; in the typical *F. vasinfectum* wilt the latter phenomenon is mostly confined to the outer woody tissue. In the new disease the discoloration is more pronounced in the lower part of the plant, becoming progressively less higher on the stem.

Isolations from the Ellis County plants yielded a *Fusarium* apparently distinct from *F. vasinfectum*, besides species of *Alternaria*, *Sclerotinia*, *Phoma*, *Phomopsis*, and *Helminthosporium*.

The occurrence of the new wilt in the heavy black lands where root rot (*Phymatotrichum*) [*omnivorum*] is destructive is considered to be specially significant. It has recently been shown [ibid., viii, p. 308] that *Fusarium* wilt is mostly confined to soils more acid than P_H 6·5 to 7·0, while root rot is destructive under more alkaline conditions. In other words, this is the first occasion on which the two types of disease, root rot and wilt, have been found in a severe form on the same soils.

According to Fahmy [ibid., vii, p. 781], there is a certain type of wilt occurring in Upper Egypt on the Ashmouni and Zagora cotton varieties which is characterized by an apparently harmless discoloration of the central cylinder of the root, hypocotyl, or lower part of

the stem. The *Fusarium* isolated from the discoloured regions failed to infect the varieties in question and the fungus is accordingly considered non-parasitic. This type of wilt appears to be very similar to that observed in Texas, except that in the latter region the discoloration is associated with a serious disease of the plants.

TAUBENHAUS (J. J.), DANA (B. F.), EZEKIEL (W. N.), BACH (W. J.), & LUSK (J. P.). **A method of inoculation for Phymatotrichum root rot investigations.**—*Phytopath.*, xix, 2, pp. 167–170, 1 fig., 1929.

An outline is given of a method evolved by the writers for the inoculation of cotton and other plants with the causal organism of root rot (*Phymatotrichum omnivorum*) [*R.A.M.*, viii, p. 308]. Recently wilted cotton or other plants are pulled by hand, the tops cut off at ground level, and the roots (usually covered with a copious surface growth of the fungus) dropped into moist sacks, kept moist, and used as rapidly as possible for inoculum. Under field conditions a crowbar is used to pierce a hole in the soil 1 to 1½ inches from the stem of the plant to be inoculated. One or more of the fresh pieces of inoculum are placed in the hole, one or two inches below the surface, and the soil pressed together again. Particularly successful results have been obtained in soils with a high moisture content. Out of 840 cotton plants at College Station, Texas, inoculated by this method in the early summer of 1928, 346 (about 41 per cent.) wilted within the next 24 days. Of 52 cotton plants inoculated with naturally infected carrot roots, 26 succumbed to the disease in six weeks. In both these lots almost every plant was killed by root rot within the following three weeks, while there was still under 1 per cent. of the disease in the adjacent control rows. Similar results were obtained in inoculations on a smaller scale for greenhouse or plot work.

Successful cross-inoculations were made by this method from cotton and various other hosts to a large number of cultivated crop plants and fruit trees, a list of which is given.

SAWYER (W. H.). **Observations on some entomogenous members of the Entomophthoraceae in artificial culture.**—*Amer. Journ. of Botany*, xvi, 2, pp. 87–121, 4 pl., 1929.

In the introductory part to this paper, the author states that he uses the generic name *Entomophthora* to cover the entomogenous species of the Entomophthoraceae with branched conidiophores and uninucleate conidia, and *Empusa* for those with unbranched conidiophores and multinucleate conidia. After a brief outline of the methods and technique adopted, he gives full details of successful experiments in growing two species, namely *Entomophthora sphaerosperma* from the black-headed fireworm (*Rhopobota vacciniana*), and a species of *Empusa* from the yellow-headed fireworm (*Peronea minuta*), on over forty different media. Both insect hosts are destructive pests of cranberry vines in the State of Massachusetts. For comparison, cultures of *Empusa pseudococci* originally isolated from *Pseudococcus calceolariae* supplied by Thaxter, were grown on the same media.

Of all the media tested, the most satisfactory results were obtained with swordfish, pork, and potato, which need no special preparation except sterilization. The results showed that both species went through their complete life-cycle in artificial culture much as in their natural hosts; liquid nutrient media, however, favoured the development of luxuriant mycelial growth, while solid media favoured the production of hyphal bodies and spores. The insect hosts were successfully infected with their respective parasites from artificial culture.

Carbohydrates and fats do not appear to be essential to the growth of these fungi, but the substratum must contain proteins to enable them to complete their life-cycle. The proteins are quickly decomposed by enzymes secreted by the fungi, without liberation of gas or odour, but with the production of acids, ammonia, and nitrites. The optimum $P_H^{\cdot}$ concentration in artificial culture was about 6·5, corresponding to that of the body juices of the insect hosts, but growth may occur over a considerable range on either side of this point. Atmospheric humidity did not influence growth or reproduction, but excessive moisture in the substratum inhibited the latter. Conidia did not germinate below a relative atmospheric humidity of about 70 per cent. at 21° C. The optimum temperature for growth and reproduction was about 21° and the maximum 34°; the minimum was not determined, but it was shown that the conidia of both species may be frozen in ice for several days without losing their germinability.

MACY (H.) & PULKRABEK (G. M.). **Parchment paper as a source of mold infection in butter.**—*Minnesota Agric. Exper. Stat. Bull.* 242, 23 pp., 2 figs. [1 on cover], 1928. [Received February, 1929.]

Areas of distinct mould growth may be produced on the surface of mould-free butter by infection with spores (e.g., of *Penicillium* and *Aspergillus* spp. and *Oidium* [*Oospora*] *lactis*) brought into contact with the butter by contaminated parchment paper used for wrapping. Similar areas may also develop on the paper itself. Varying periods (up to several weeks) may elapse before the mould growth becomes visible to the naked eye in the form of deeply coloured patches on the butter or parchment at 35° to 55° F. The mould spores may be destroyed by the complete immersion of the paper in boiling water or a 35 per cent. solution of boiling brine (supersaturated sodium chloride) for at least five minutes. Various chemicals [which are enumerated] also proved effective in the destruction of the spores, but there are obvious objections to this form of treatment.

A bibliography of 76 titles is appended.

BENCINI (A.) & FEDERICI (E.). **Su due nuove specie di miceti rinvenuti nella cornea.** [On two new species of fungi encountered in the cornea.]—*Atti R. Accad. Fisiocritici Siena*, Ser. X, iii, 5–6–7, pp. 743–766, 8 figs., 1929.

Full clinical, morphological, and cultural details, together with Latin diagnoses, are given of two new species of fungi occurring in the cornea of the human eye. The first is named *Cryptococcus*

cavarae Poll. et Turc., and is characterized by globular or oval cells (the former measuring 4 to 7 μ in diameter and the latter 6 to 9 by 4 to 6 μ) and in the later stages also by elongated, subcylindrical cells, 14 to 24 by 3 to 5 μ; it is considered to be allied to *C. harteri*, from which it differs in the whitish to creamy-yellow colour of its colonies and in the shape and size of the cells.

The second fungus, named *Monilia cornealis* Nannizzi, may be recognized by its globular cells measuring 3·5 to 4 or 3·6 to 4·5 μ and its oval or elliptical ones, 3·6 by 1·8 or 6 by 4·5 to 4·8 μ; cylindrical, septate hyphae bearing ovate-elliptical conidia (3 to 4·5 by 2·3 μ) or subrotund ones, 3·5 to 4·5 μ in diameter; and terminal, globular chlamydospores, 3 to 6 μ in diameter.

De Mello (F.) & Rodrigues (A.). **Sur un cas de blastomycose à placards multiples végétants verruqueux ou pustulo-ulcérés.** [On a case of blastomycosis with numerous vegetative verrucose or pustulo-ulcerated plaques.]—*Bull. Soc. Path. Exot.*, xxii, 3, pp. 142–147, 2 figs., 1929.

Full clinical details are given of a case of blastomycosis in an 18-year-old native of Nova Goa (Portuguese Indies) which is of interest because it is the first recorded in the country and also showed certain histological deviations from Gilchrist's accepted type of lesion, e.g., in the absence of giant cells and of infiltration. The disease is characterized by the development, on the hands and legs, of vegetative verrucose or pustulo-ulcerated plaques of varying dimensions and irregular form, microscopic examination of which revealed the presence of hyphae measuring 8 to 40 by 1 to 1·5 μ, probably those of a *Nocardia* [*Actinomyces*], and the cellular and mycelial elements characteristic of *Monilia, sensu stricto*. The latter organism, the cells of which measured 8 μ in diameter, was isolated and inoculated into a rabbit and a white mouse with positive results and is believed to be the chief cause of the disease. All attempts to isolate the *Actinomyces* failed, and therefore its exact significance in the etiology of the condition cannot be determined.

Weiss (C.) & Landrón (F.). **Immunological investigations on tropical sprue in Porto Rico. 4. The biology of Monilia psilosis in relation to sprue.**—*Journ. Infect. Dis.*, xliii, 6, pp. 557–564, 1 graph, 1928.

The isolation of *Monilia psilosis* from faeces was greatly facilitated in the authors' experiments by the use of glycerol and bile to inhibit the growth of common faecal bacteria. With the aid of this technique [details of which are given] the fungus was obtained from a large number of sprue cases and controls [*R.A.M.*, viii, p. 445]. The organism grows on both liquid and solid media over a wide range of hydrogen-ion concentration, with an optimum growth at P_H 7 in infusion broth. In liquid media of low hydrogen-ion concentration, its growth induces progressive alkalinity up to a point approaching P_H 8, the apparent optimum for survival.

Intravenous injection of *M. psilosis* was found to kill rabbits in periods varying from a few minutes to 48 hours, according to the strength of the dose. In the later deaths visceral embolic lesions

containing the fungus were found. Similar results were obtained with *Monilia* [*Candida*] *albicans* and a *Cryptococcus* from cutaneous blastomycosis. All these organisms contain endotoxins which, however, are not haemolytic or specifically antigenic when tested intradermally on immunized rabbits, sprue cases, and human controls. A filterable non-haemolytic exotoxin can also be demonstrated in each of the three fungi.

MACKIE (F. P.) & CHITRE (G. D.). **Animal experiments and sprue.**—*Indian Journ. Med. Res.*, xvi, 1, pp. 49–76, 1 pl., 1928.

The results [which are described and tabulated] of a series of experiments on monkeys and other animals showed that when *Monilia psilosis* [see preceding abstract] and other strains of *Monilia*, including *M. krusei* [*R.A.M.*, viii, p. 104] and *M.* [*Candida*] *albicans*, are injected by the peritoneal route, a small proportion of the subjects die of peritonitis with or without a generalized *Monilia* septicaemia. A larger number show a mild degree of plastic peritonitis and recover, while many fail to react at all to one or more doses.

No elevation of virulence results from the passage of *M. psilosis* through a series of animals by intraperitoneal injection.

Negative results were obtained when healthy animals were fed on cultures of the organisms under investigation. The faeces of such animals frequently show the presence of a strain of *Monilia* indistinguishable from *M. psilosis*. Severe gastro-intestinal disturbances were induced in monkeys kept on a diet deficient in vitamin C, quite apart from inoculation with *M. psilosis*, and it is concluded that there is as yet no evidence of the experimental transmission of sprue to animals.

MARTINS (C.). **Études expérimentales sur l'Aspergillus fumigatus.** [Experimental studies on *Aspergillus fumigatus*.]—*Comptes rendus Soc. de Biol.*, c, 7, pp. 525–526, 1929.

In the writer's experiments on rabbits, negative results were given by inoculation with filtrates of cultures of *Aspergillus fumigatus* [*R.A.M.*, viii, p. 242], whereas the injection of (*a*) a mixture of spores and mycelium ground in a mortar to produce a homogeneous paste, (*b*) a spore emulsion 'tyndallized' [sterilized by intermittent heating] for one hour in a water bath at 60° C., and (*c*) a spore emulsion heated to 100°, resulted in the development of paraplegia, paralysis, congestion, and other typical symptoms of infection [ibid., vii, p. 632]. This would seem to point to the existence of an endocellular toxin in the fungus.

TSCHERNIAK (W. S.). **Ein Fall von sekundärer Rhinomykose bei einem an Petechialfieber erkrankten Pferde.** [A case of secondary rhinomycosis in a horse suffering from petechial fever.]—*Deutsche tierärztl. Wochenschr.*, xxxvii, 7, pp. 99–101, 2 figs., 1929.

The pathological and histological symptoms of a case of secondary rhinomycosis in a horse are fully described. A fungus isolated from an abscess on the nasal septum was identified by Prof.

Jaczewski as *Aspergillus nidulans* [*R.A.M.*, vii, p. 782]. This is believed to be only the second record of this organism in a domestic animal, the first case being reported by the present writer in *Arch. wissensch. u. prakt. Tierheilkunde*, lvii, p. 417, 1928.

BILTRIS (R.). **Sur la variabilité des caractères de l'espèce chez les Dermatophytes.** [On the variability of the specific characters of the Dermatophytes.]—*Ann. Inst. Pasteur*, xliii, 3, pp. 281–342, 15 pl., 1929.

This is a lengthy discussion, based on current studies of the writer and others, on the variability of specific characters in the dermatophytes. In the present state of knowledge all attempts at a reform of the existing system of classification are considered to be premature [cf. *R.A.M.*, viii, p. 446].

TAKAHASHI (S.). **Biologische Studien über die Trichophyten.** [Biological studies on the *Trichophyton* fungi.]—*Japanese Journ. of Dermatology*, xxix, 2, pp. 134–151, 1929. [Japanese, with German summary on pp. 14–16.]

In his investigations on the prevalent dermatophytes, *Trichophyton radiolatum*, *T. purpureum*, and *Epidermophyton inguinale*, in Japan [*R.A.M.*, viii, p. 173] the writer has found glycerine agar an excellent substitute for Sabouraud's medium. The morphological structures characteristic of this group of organisms, e.g., spindle spores, chlamydospores, spirals, and the like, develop equally well on both media, while the glycerine agar has the further advantage of restoring the faculty to develop these organs which may be lost on other media, e.g., peptone. Similar observations were made in connexion with *T. asteroides*, *T. granulosum*, and *T. farinulentum*.

SULZBERGER (MARION B.). **Experimentelle Untersuchungen über die Dermatotropie der Trichophytonpilze.** [Experimental investigations on the dermatotropism of *Trichophyton* fungi.] —*Arch. für Dermatol.*, clvii, 2, pp. 345-357, 1929.

Continuing her investigations on infection by fungi causing dermatomycosis, the writer carried out a number of inoculation experiments [which are fully described] on guinea-pigs with *Achorion quinckeanum* [*R.A.M.*, viii, p. 309]. In no case did the internal organs become diseased by the subcutaneous or even intracardial injection of spore emulsions of the fungus, notwithstanding the presence of the organism both in the organs and in the blood stream. The localization of the dermatomycoses in the horny tissues of skin and hair would seem to be due to the fact that these substances provide optimum, if not indispensable, conditions for growth, reproduction, and pathogenic action of the fungi concerned.

CATANEI (A.). **Résultats des inoculations de souches algériennes de Trichophyton violaceum aux animaux.** [Results of inoculations on animals with Algerian strains of *Trichophyton violaceum*.]—*Comptes rendus Soc. de Biol.*, xcix, 33, pp. 1552–1554, 1928.

In a series of inoculation experiments with numerous Algerian

strains of *Trichophyton violaceum* [*R.A.M.*, viii, p. 241], positive results were obtained on two dogs, one out of three cats, two monkeys (*Macacus inuus*), and one out of 15 guinea-pigs. The clinical appearance of the lesions on the different animals is described ; particularly on the dogs and monkeys the resemblance to the symptoms of ringworm in man was very striking.

CATANEI (A.). **Sur le pouvoir pathogène des Trichophyton violaceum et glabrum pour les animaux.** [On the pathogenic action of *Trichophyton violaceum* and *glabrum* towards animals.]—*Comptes rendus Soc. de Biol.*, c, 13, pp. 1108–1110, 1929.

The writer briefly recapitulates the results of his inoculation experiments on animals with *Trichophyton violaceum* [see preceding abstract], and states that he subsequently obtained similar results on two guinea-pigs with *T. glabrum*. The ringworm produced by the latter organism is analogous to that caused by *T. violaceum*, the only difference between the two fungi lying in the purple pigmentation of the latter in culture. Notes are given on the clinical symptoms of the disease.

BERLINER (C.). **De l'épilage des peaux par la moisissure d'Aspergillus oryzae dénommée 'sojal'.** [On the depilation of skins by the mould *Aspergillus oryzae* known as 'sojal'.]—*Cuir Tech.*, xvii, 23, pp. 508–509, 1928.

Satisfactory results are stated to have been given by Abt's process of skin depilation by means of the diastases of *Aspergillus oryzae* ('sojal') [*R.A.M.*, viii, p. 106]. The cost of this preparation is high (Fr. 50 to 60 per 100 kg. of hides compared with Fr. 15 for lime or sulphur), but it possesses several advantages [which are indicated]. The operation should be carried out at a temperature of 37° C. after soaking the hides for 24 hours in a bath of sojal. In order to avoid any risk of putrefaction an antiseptic, e.g., 5 per cent. cresol, should be added to the bath where any delay in removing the skins is anticipated. A preliminary swelling of the hides may be effected by immersion in a bath of water heated to 30° with the addition of 4 kg. of caustic soda (96 per cent.) per 1,000 l. After depilation the hides should be treated with formic or lactic acid for 24 hours prior to tanning.

De l'épilage des peaux par la moisissure d'Aspergillus oryzae dénommée 'sojal'. [On the depilation of skins by the mould *Aspergillus oryzae* known as 'sojal'.]—*Cuir Tech.*, xviii, 1, p. 10, 1929.

Referring to Berliner's article on the depilation of skins by means of sojal [see preceding abstract], a representative of the Compagnie Industrielle des Diastases points out that a temperature of 37° C. is too high for smooth leather, which should be treated at about 25°. The hides should not be left longer than 36 hours in a bath of sojal without the adoption of special precautions. The recommendation of 5 per cent. cresol as an antiseptic is presumably an error, this figure being about 20 times too high. Commercial cresols, moreover, are seldom sufficiently pure for this purpose.

BERLINER (C.). **De l'épilage des peaux par la moisissure d'Aspergillus oryzae.** [On the depilation of skins by the mould *Aspergillus oryzae*.]—*Cuir Tech.*, xviii, 7, pp. 132–133, 1929.

Further technical details are given concerning the process of skin depilation by means of the diastases extracted from *Aspergillus oryzae* [see preceding abstracts].

BERTUS (S. L.). **A sclerotial disease of Pentas carnea Benth.**—*Trop. Agriculturist*, lxxii, 3, pp. 129–132, 1929.

A number of plants of *Pentas carnea* in a nursery of the Royal Botanic Gardens, Peradeniya, were found in 1928 to be attacked by a strain of *Rhizoctonia* [*Corticium*] *solani* similar in its cultural characters and pathogenic properties to that which was described by the author in a previous paper on *Vigna oligosperma* [*R.A.M.*, vii, p. 744]. The control measures recommended are cutting off and burning the diseased stems and leaves of the plants, the removal of fallen leaves from the beds, and the thinning of the stands.

HAIGH (J. C.). **Geranium stem rot caused by Pythium sp.**—*Trop. Agriculturist*, lxxii, 3, pp. 133–134, 1929.

A brief description is given of the symptoms caused on the stem of a geranium plant in Ceylon by a species of *Pythium* which was shown in pure culture to be allied to, if not identical with, the fungus responsible in other countries for damping-off of seedlings in nurseries [*P. de Baryanum*].

SALMON (E. S.) & WARE (W. M.). **Two downy mildews of the Nettle: Pseudoperonospora urticae (Lib.) Salm. et Ware and Peronospora de Baryi nomen novum.**—*Trans. Brit. Mycol. Soc.*, xiv, 1–2, pp. 38–60, 6 figs., 1 diag., 1929.

The discovery in 1926 of the occurrence at Wye, Kent, of two morphologically distinct species of downy mildew of the nettle, led the authors to undertake a critical examination of the information contained in literature on *Peronospora urticae* and of the material available in European herbaria. The samples received by them under this name from various exsiccata contained, besides the species with oval, minutely apiculate conidia which was named by Berkeley in 1846 *Botrytis urticae* Libert MSS., renamed *Peronospora urticae* by Caspary in 1855, and which the authors in 1925 transferred to the genus *Pseudoperonospora* [*R.A.M.*, iv, p. 703], another species with broadly ovoid or subglobose conidia, very obtuse at the apex and lacking an apiculus, which is identical with the fungus erroneously identified by De Bary in 1863 as *Peronospora urticae*, his error presumably arising from a drawing sent by Berkeley to Caspary. A detailed description is given of the morphological and biological characters of the latter species, which unlike that first named germinates by a germ-tube and is a true *Peronospora*, for which the name *P. de Baryi* is proposed. Brief Latin diagnoses of the two species are also given, as well as their geographical distribution.

P. urticae is known to occur on *Urtica urens* and *U. dioica*, while *Peronospora de Baryi* has been found on *U. urens* only.

Inoculation experiments [details of which are given] indicated that the latter fungus causes a systemic infection of the host, the symptoms produced by it and the distribution of the hyphae within the tissues being fully described.

FENTON (E. W.). **Seed mixtures and the incidence of fungal disease.**—*Trans. Brit. Mycol. Soc.*, xiv, 1–2, pp. 88–93, 1929.

In this brief note the author discusses the composition of seed mixtures used for the establishment of permanent grassland as affecting the general health of the plant association so created. Field observations in 1926 and 1927 showed that in areas where drought is a factor, white clover is of considerable value, since it is an important source of nitrogen in the superficial layer of the soil and also tends to preserve the soil from rapid desiccation. In a plot with a very thin cover of white clover, cock's-foot and ryegrass [*Dactylis glomerata* and *Lolium perenne*] suffered from rust (*Uromyces dactylidis* and *Puccinia lolii*, respectively), while in plots where white clover covered from 59 to 73 per cent. of the surface all the grasses of the pasture remained generally free from fungal diseases. This observation is interpreted as indicating the necessity of using well-balanced seed mixtures in order to avoid creating unfavourable physiological conditions for the pasture plants.

BENEDICT (D. M.). **A greenhouse study of the conidial stroma of Epichloe typhina.**—*Papers Michigan Acad. Sci. Arts and Letters*, ix, pp. 47–54, 1929.

Clumps of *Glyceria nervata* heavily infested with *Epichloe typhina* [*R.A.M.*, vii, p. 327] were collected near Ann Arbor, Michigan, during October and November, 1928, and placed in large pans in a greenhouse at a temperature between 70° and 80° [F.] with a high relative humidity. The plants continued to make normal growth and some of the culms produced inflorescences on which numerous stromata developed, the largest number occurring on clumps collected on 25th November after a spell of rather cold weather. The first stromata appeared during January, 1928; there was no perceptible difference between the culms destined to bear these organs and those which failed to produce them. However, about two days before the appearance of the stroma, its outline was clearly discernible below the leaf sheath in the lower part of the internode almost or quite reaching the node. The elongation of the internode, which finally liberates the stroma from the leaf sheath, marks the end of growth in length of that particular culm, infected individuals producing no inflorescences. On diseased culms, therefore, the stroma is always situated on the uppermost internode.

The stromata being fully formed while still covered by the leaf sheath, the conidia are ready to function as soon as they are completely exposed. Viable conidia were present on individual stromata in the greenhouse for a period of 10 to 14 days. Germination occurs in 15 to 18 hours at 18° to 21° C.; the minimum temperature for germination was found to lie between 4° and 10° (probably near the latter point). The process was greatly retarded

by exposure to light. Germination is effected by means of germ-tubes at each end of the spore, one developing only after the other has already reached a length of 40 to 50 times that of the spore.

WARE (W. M.). **Note on Rhizoctonia crocorum (Pers.) DC.**—*Trans. Brit. Mycol. Soc.*, xiv, 1–2, pp. 94–95, 1929.

In this brief note the author reports the occurrence in 1927 of *Rhizoctonia crocorum* on black medick (*Medicago lupulina*) in the same field [at Wye, Kent] in which, in 1923, he had found this fungus attacking red clover [*R.A.M.*, ii, p. 450]. In this case, as in the former, *R. crocorum* was followed in the spring by *Helicobasidium purpureum* which occurred on the stems and stipules of the diseased plants. This is apparently the first record of *R. crocorum* on black medick in England.

RICHARDS (B. L.). **White spot of Alfalfa and its relation to irrigation.**—*Phytopath.*, xix, 2, pp. 125–141, 10 figs., 1929.

In certain western areas of the United States where irrigation is necessary, the white spot disease of lucerne [*R.A.M.*, vii, p. 619] may be of considerable economic importance. Affected plants develop small, definitely delimited, bleached, necrotic areas in the mesophyll of the leaf. All the leaves on a stem become involved simultaneously and more or less uniformly. In Utah, where the writer's investigations were made, a marginal injury also occurs, chiefly in the second and third crops. In both forms of the disturbance practically the entire leaflet area is affected, leaving only a narrow strip of green along the mid-rib and a few of the lateral veins. A careful study of the incipient phases of the lesions showed that the first sign of white spot is the appearance of opaque areas in the mesophyll. Accompanying the substitution of air for water (to which the opacity is probably due) in the injured tissue is a slight depression of the surface and a change of colour, through several gradations, from deep chlorophyll green to white or pale yellow or tan. Finally (within 48 to 60 hours under dry conditions) the affected tissue becomes entirely bleached. The damage caused by white spot (which affected 15 to 75 per cent. of the plants in some fields in the Cache Valley in 1926) ranges from slight injury to death. Even when the stems are not destroyed, the loss of leaves (which afford some two-thirds of the food value of lucerne) may greatly reduce the value of the crop. Farmers report that hay affected by white spot is avoided by animals.

Sweet clover (*Melilotus alba*) and black medick (*Medicago lupulina*) are affected by a disturbance similar to white spot as regards the time of occurrence and distribution of the lesions; the final colour of these, however, is dark brown on the former host while on the latter it resembles that of the spots on lucerne.

It was ascertained during 1926 and 1927 that white spot of lucerne, which is reported from a considerable area in the United States, is greatly influenced by rainfall and irrigation. The disease was experimentally produced by the application of irrigation water to fields not previously watered, in a number of places at different times on both the first and the second crops. Where fields had been accidentally flooded the disease was observed to be confined

to the flooded areas. The symptoms were found to develop simultaneously on all the watered plants, usually early in the morning after the water had run during the previous night. In general, the data indicate that the condition is due to unbalanced water relations.

Earlier, more frequent, and lighter irrigations are suggested as a possible means of preventing white spot in the first crop.

Petherbridge (F. R.) & Dillon Weston (W. A. R.). **Observations on the spread of the Apple mildew fungus, Podosphaera leucotricha (Ell. and Ev.) Salm.**—*Trans. Brit. Mycol. Soc.*, xiv, 1–2, pp. 109–111, 1929.

Some details are given of field observations made in 1927 and 1928 in the neighbourhood of Cambridge, the results of which provided ample evidence that secondary infection may be an important factor in the spread of the apple mildew (*Podosphaera leucotricha*) in the apple varieties Chivers Seedling and Bramleys Seedling. Observations in fruit plantations tended to show that this may also be true for certain other varieties. These facts are contradictory to Woodward's statement that the presence of the mildew in spring is entirely dependent upon the existence of infected buds on the trees, and that it does not generally spread by secondary infection [*R.A.M.*, vi, p. 732].

Petherbridge (F. R.) & Dillon Weston (W. A. R.). **Successful control of Apple scab in the Wisbech area.**—*Journ. Min. Agric.*, xxxvi, 1, pp. 45–51, 1 pl., 1929.

Spraying experiments [of which full details are given] against scab [*Venturia inaequalis*] conducted during two years on Worcester Pearmain apples at Wisbech showed an average net profit of nearly £50 per acre when the trees were sprayed with home-made excess lime Bordeaux mixture either full (10–3–40) or half (5–1½–40) strength; lime-sulphur (1 in 30 for the first spray and 1 in 60 afterwards) gave an average profit of about £37 10*s.* 0*d.* per acre. The first spraying was done on 1st to 2nd May when the blossoms were showing pink, and the second on 21st to 23rd May after the fruit had set. In 1928 a third spraying on 15th June was added. The cost of spraying varied from about £4 per acre in 1927 to £6 in 1928. The control plot showed 93 per cent. badly scabbed apples in 1927 and 90 per cent. in 1928, while that receiving full strength Bordeaux had only 9 per cent. badly scabbed with nearly double the crop in 1927 and 7 per cent. with nearly 3 times the crop in 1928. Spraying with tar-oil alone (10 per cent. winter wash) proved of very little value.

Carne (W. M.), Pittman (H. A.), & Elliott (H. G.). **Notes on certain disorders of Cleopatra Apples.**—*Journ. Australia Council Sci. & Indus. Res.*, ii, 1, pp. 49–52, 1 pl. [facing p. 54], 1929.

During storage experiments conducted in Australia on bitter pit it was noted that Cleopatra apples were very liable to three disorders [the symptoms of which are indicated] which appear to be related to the type of growth that is characteristic of this variety. These

were 'woolly stripe', 'hollow core', and 'mouldy core'. All three are the result of irregular, rapid growth. In a variety such as Cleopatra, which increases in size very rapidly when maturing, the strains set up in the older tissues by the growth of the new ones produce ruptures which cause woolly stripe and hollow core. The breaks in the flesh appear to be most common at the base of the calyx tube, which in Cleopatras is relatively wide and open, allowing the ingress of spores; the ruptures in the carpellary walls and the flesh allow rot fungi to become established, and mouldy core sets in. Examination of mouldy core tissue showed the presence of species of *Alternaria*, *Oospora*, *Penicillium*, and bacteria, while in the brown flesh rupture following hollow core *Penicillium*, *Cladosporium*, *Acrostalagmus*, *Gloeosporium*, and bacteria were found.

HURT (R. H.) & SCHNEIDERHAN (F. J.). **Calcium sulphide for the control of Apple and Peach diseases.**—*Virginia Agric. Exper. Stat. Tech. Bull.* 36, 15 pp., 2 figs., 1929.

During the past three years the writers have obtained excellent control of apple scab (*Venturia inaequalis*) and peach scab and brown rot (*Cladosporium carpophilum* and *Sclerotinia cinerea* [*S. Americana*], respectively) with a preparation, such as is used in the U. S. Pharmacopoeia, composed of calcium sulphide (containing 60 to 65 per cent. CaS), anhydrous calcium sulphate, and small quantities of reducing agents (e. g., powdered coal), applied at the rate of 8 or 12·5 lb. per 50 galls. of water [*R.A.M.*, viii, p. 387]. The tests showed that this material may safely be used throughout the season on such apple varieties as Winesap and Ben Davis, but it should not be substituted for Bordeaux mixture on varieties susceptible to bitter rot [*Glomerella cingulata*: ibid., vi, p. 620]. Calcium sulphide is stated to be easy to mix and less caustic to the leaves and fruits of apples and peaches than any of the usual standard fungicides; moreover it adheres better than dry-mix sulphur-lime and will keep indefinitely under air-tight conditions.

GODDARD (E. J.). **Bunchy top in Bananas.**—*Journ. Australia Council Sci. and Indus. Res.*, ii, 1, pp. 21–27, 2 pl. [between pp. 54 and 55], 1929.

After briefly describing in popular terms the symptoms and distribution of bunchy top of bananas [*R.A.M.*, viii, p. 184] the author summarizes the investigation conducted since 1924 by the Bunchy Top Investigation Committee [ibid., vi, p. 173] and states that further experiments in Queensland and the Philippine Islands upon the transmission of the disease by the dark banana aphid (*Pentalonia nigronervosa*) have completely confirmed the conclusions previously reached.

The history of the disease in Australia is markedly consistent with the ideas put forward by the Committee. The site of the first occurrence of bunchy top in Australia has been identified; diseased plants were brought there from Fiji, where the condition has been known since 1885, and the disease was spread from this locality by the removal of suckers to other plantations. The early history of Currumbin in south-eastern Queensland shows that the

disease appeared here immediately after suckers had been imported from the vicinity of the Tweed River in New South Wales, where bunchy top was already widely prevalent. During the past three years bunchy top has appeared spasmodically along the northern coast of Queensland, and has occurred at places fifty miles away from the nearest affected plantation. In every instance only the younger leaves were affected, indicating that the plants had originally been healthy and had become infected through the agency of aphids.

Observations on *P. nigronervosa* under nets and in glass-houses showed that the winged forms tend to ascend rather than to fly actively; this was noted so frequently that it suggests that the insects make use of air currents in their migrations. As individual winged forms have been observed to maintain themselves on the wing for over four hours, it is concluded that with the help of a breeze the aphids could be carried over great distances.

Careful analysis established that the periods of rapid diffusion of bunchy top are correlated with the maximum winged migration of the aphids during September and from November to April.

The biggest problem in control at the present time is stated to be how to destroy the deserted plantations.

An example is cited of a plantation where two originally healthy plants were found to show bunchy top among 22,000 others. The grower strictly adhered to the recommendations laid down by the Bunchy Top Committee, and as a result has lost only fifty plants up to the present. Even more encouraging is the case of Currumbin Valley, where originally 250 men were engaged in the banana industry. Four years ago production ceased owing to the ravages of bunchy top, and a year later the position was such that all new plants planted in this area would be likely to become affected within six months. Since then the valley has been completely cleared up, and some 7,000 plants have been set on selected sites; at the time of writing two plots of 1,000, one of 300, and another of 600 plants are free from the disease.

GODDARD (E. J.). **Squirter disease in Bananas—preliminary report.**—*Journ. Australia Council Sci. & Indus. Res.*, ii, 1, pp. 27–31, 1929.

Squirter disease [*R.A.M.*, viii, p. 256] affects bananas grown in that part of Queensland which stretches from the New South Wales border to Gympie, and within this region the fruit is much more severely affected in some localities than in others. It has not yet been recorded north of the Herbert river. It is strictly seasonal, occurring between April and October.

It has been definitely established that the disease is in no way associated with any bacterial or fungal organism or with rate and method of ripening, all the evidence indicating that it is of physiological origin.

Investigation showed that squirter appeared only in bananas sent from south-eastern Queensland to the main market in Melbourne, independently of the route by which they were dispatched; in no instance was it ever detected in fruit from northern Queensland dispatched to Melbourne, or in fruit from any region

retained in Brisbane. There are definite indications that climate and transport are causal factors. It would appear that bananas grown in certain areas suffer during winter from a physiological disturbance which responds to unsuitable temperature or other conditions during transit and produces squirter. It is considered that a partial ripening of the fruit before dispatch from Queensland may to some extent control the condition.

GOODWIN (W.) & MARTIN (H.). **The action of sulphur as a fungicide and as an acaricide. Part II.**—*Ann. of Appl. Biol.*, xvi, 1, pp. 93–103, 1 fig., 1929.

The purpose of the experiments briefly described in this paper was to test by biological means the conclusion arrived at in the authors' previous communication [*R.A.M.*, viii, p. 391] as to the gaseous nature of the active agent involved in the fungicidal and acaricidal action at a distance of sulphur when applied to a heated surface. The indicators selected were the mildews of the hop (*Sphaerotheca humuli*) and *Agropyron repens* (*Erysiphe graminis*) and the black currant gall mite (*Eriophyes ribis*). In the two fungi the results were unsatisfactory and inconclusive owing to insufficient sensitiveness of the organisms. They strongly supported, however, the view that the fungicidal action of sulphur entirely depends on actual contact of the sulphur particle with the fungus, sulphur vapour not being toxic until the volatilized sulphur is re-condensed upon the organism. The results with the gall mite (which proved to be highly sensitive to the action of the sulphur emanations) were in complete accord with those obtained in the previous chemical work. The fact that the agent present in air that had passed over heated sulphur was not removed by filtration through a heated glass-wool plug, and was only removed in part by filtration through a cooled plug, is contrary to the view that the toxic agent is produced initially in solid form. In a separate series of experiments, sulphur dioxide and hydrogen sulphide did not have a permanent effect upon the gall mite, the inference being that these gases are not responsible for the acaricidal action of sulphur.

GRAM (E.). **Afsvampningsmidlernes Kviksølvindhold.** [The mercury content of fungicides.]—*Ugeskr. for Landmaend*, lxxiv, 8, pp. 221–222, 1929.

Replying to an inquiry concerning the correct rate of application of germisan and other fungicides, based on their mercury content, the writer states that this cannot always be accepted as a criterion. Thus in 1928 the percentage of stripe disease [of barley: *Helminthosporium gramineum*] in a Danish experiment with various fungicides was as follows: sprinkling with 30 or 60 gm. [per 100 kg. of seed-grain] of germisan (17·5 per cent. mercury), 4 and 0, respectively; with the same quantities of tillantin C (4 per cent. mercury), 2·3 and 0, respectively. The incidence of stripe disease in barley plots from seed dusted with 100 gm. of tillantin C was 0·3 per cent., compared with 3·8 per cent. where tutan (150 gm.) was used.

HANSEN (H. H. H.). **Afsvampningsforsøg. Fra Landboforeningernes Forsøgsarbejde 1928.** [Disinfection experiments. From the agricultural societies' experimental work 1928.]—*Ugeskr. for Landmaend*, lxxiv, 9, pp. 136–137, 1929.

Some details are given of the results obtained in a series of Danish experiments in the disinfection of cereal and beet seed during 1928. Germisan and tillantin C appear to be equally effective in liquid and dry form. Abavit B, tillantin C, germisan, and betanal have given good results in the disinfection of beet seed-clusters [against root rot: *Phoma betae, Pythium de Baryanum*, and *Aphanomyces levis*: *R.A.M.*, viii, p. 417]. Stripe disease of barley [*Helminthosporium gramineum*] was reduced in two experiments from between 30 and 40 per cent. to a trace by sprinkling with 60 gm. of germisan or tillantin C dissolved in 3 l. of water, while in another series of tests danatin and a preparation known as no. 101 also proved satisfactory in the control of this fungus. Directions are given for the mode of application of the various preparations.

NIETHAMMER (A[NNELIESE]). **Die Beeinflussung der Pollenkeimung unserer Nutz- und Ziergewächse durch die verschiedensten Giftstoffe, die im Pflanzenschutzdienste angewendet werden.** [The influence on the pollen germination of our economic and ornamental plants of the most diverse toxic substances used in the plant protection service.]—*Gartenbauwissensch.*, i, p. 471, 1929. [Abs. in *Fortschr. der Landw.*, iv, 9, p. 292, 1929.]

Certain fungicides, e.g., lime-sulphur mixture (Radit), and sulikoll appear, from the writer's experiments in Prague, to be innocuous to the plants on which they are sprayed, whereas others, including dendrin, neodendrin, and solbar may cause considerable damage by preventing the ripening and germination of the pollen grains. Such preparations should not be applied during the flowering period of the plants.

FRIGERIO (M.). **Sul contenuto in rame delle foglie di Barbabietole trattate con preparati cuprici.** [On the copper content of Beet leaves treated with cupric preparations.]—*Giorn. Chim. Ind. Appl.*, xi, 2, pp. 67–69, 1929.

The results of investigations conducted at the Milan Agricultural College showed that the amount of copper retained after lifting by the leaves and tops of beets treated with cupric preparations against leaf spot (*Cercospora beticola*) varied widely according to the number and intensity of the applications, and also with different weather conditions. About one-third of the total copper present is dissolved by the gastric and pancreatic juices of the cattle fed on the treated leaves [*R.A.M.*, viii, p. 9]. The use of the leaves and tops for silage does not appreciably influence the solubility or toxicity of the copper compounds present.

FULTON (H. R.) & COBLENTZ (W. W.). **The fungicidal action of ultra-violet radiation.**—*Journ. Agric. Res.*, xxxviii, 3, pp. 159–168, 3 pl., 1929.

The original purpose of the authors' experiments was to test the possibility of controlling storage rots of oranges (*Penicillium digitatum* and *P. italicum*) by subjecting the fruit to ultra-violet radiations, and this was subsequently extended to include the study of the action of the rays on the spores of 25 other species of fungi [a list of which is given]. The apparatus consisted of a 110-volt quartz-enclosed mercury-tungsten arc (normally operated on 320 watts), and the spores were tested on the surface of hard nutrient agar in Petri dishes. The results showed that the radiations have a decided lethal action on the spores, in most cases after a comparatively short exposure [cf. *R.A.M.*, viii, p. 190]. In 16 of the species tested an exposure for one minute at a distance of 6 inches resulted in the killing of all the spores; in four other species there was a survival of less than 1 per cent., and in the remaining seven survival ranged from 2 to 53 per cent., the spores with dark walls exhibiting the greatest resistance. In *P. digitatum*, an exposure of five seconds at 6 inches was sufficient to kill 907 out of 1,000 spores, while with an exposure of 45 seconds 998 out of 1,000 were killed, the survival of the few spores being tentatively explained by partial shading.

Fungicidal efficacy of ultra-violet treatment is directly proportional to the length of exposure and inversely proportional to the distance from the source of the rays, in other words, to the intensity of illumination. It is also dependent on the wave length of the rays, the lethal action beginning somewhere about a wave length of 365 $\mu\mu$ as the upper limit, and increasing in intensity as the wave length is shorter. The killing effect is cumulative, several short intermittent exposures having almost the same effect as one continuous exposure of the same total duration. Growing mycelium is more sensitive to the action of the rays than the spores.

Further experiments made to test the applicability of the treatment to the control of orange storage rot, showed that decay in oranges inoculated with spores of *P. digitatum* was only moderately retarded under the conditions of the test, which are believed to represent the limit of economical practice. The principal physical limitations to the use of ultra-violet rays for complete disinfection of fruits seem to be their inability to penetrate to any great distance below the surface, so as to destroy mycelium that may have already entered, and the accidental shading of some of the spores on the surface, which thus escape killing. In the dosages used the ultra-violet rays did not appear to have any injurious effect on the oranges.

VAN DER BIJL (P. A.). **Plantsiektes: hul oorsaak en bestryding.** [Plant diseases: their cause and control.]—vii+404 pp., 115 figs., Nasionale Pers Beperk, Cape Town, 1928.

The first part of this book is devoted to a general survey of the structure and life-history of fungi, their mode of reproduction, and systematic classification. The second part deals with the causes

and control of plant diseases and comprises chapters on the influence of environmental factors on plant growth and the occurrence of infection; fungi and bacteria as causes of plant disease; general principles for the control of plant diseases caused by fungi and bacteria; the composition, preparation, and application of fungicides and disinfectants; and phanerogamic parasites of economic plants. The third part treats of the chief diseases of plants of economic importance in South Africa arranged by the hosts (fruit, vegetables, cereals, and other agricultural crops, and ornamentals), including besides many common temperate ones, mango, mulberry, walnut, papaw, citrus, vine, maize, cotton, lucerne, sugar-cane, and tobacco. Many of the illustrations are original and a seven-page host index is appended.

List of common names of British plant diseases.—*Trans. Brit. Mycol. Soc.*, xiv, 1–2, pp. 140–177, 1929.

This list was compiled by the Plant Pathology Sub-Committee of the British Mycological Society for the purpose of selecting and recommending for general use a single popular name for each of the more important diseases of those crop and ornamental plants which are cultivated on a large scale in the British Isles. The great majority of the common names selected are already well known in general practice, but in some instances, where the existing popular name is inappropriate for technical reasons, a new name has been devised. In some cases, an alternative name has been retained, in order to avoid creating obscurity in the minds of some growers, but it is hoped that these will gradually be abandoned. In each case, the common name of the disease is followed by the scientific name of the causal organism, with the indication of the respective authorities for it. It is stated that care has been taken to ensure that these names are correct in accordance with the International Rules of Botanical Nomenclature. For those diseases which are also prevalent in the United States, France, Italy, Germany, Holland, and Denmark, some of the popular names used in these countries are also listed. The diseases are arranged by the host plants which are grouped under such headings as Cereals, Vegetables, and the like.

[The scientific names adopted in this list for common crop parasites will be used in future in the *Review of Applied Mycology*.]

DILLON WESTON (W. A. R.). **Observations on the bacterial and fungal flora of the upper air.**—*Trans. Brit. Mycol. Soc.*, xiv, 1–2, pp. 111–117, 1929.

Some brief details are given of the apparatus used for trapping fungal spores and bacteria at various altitudes in aeroplane flights which were made from time to time in the neighbourhood of Cambridge from the end of 1926 to the middle of 1928. The results showed that both types of organisms may be found viable at considerable heights. Although in one flight only bacteria and no spores were trapped at 9,000 and 10,000 feet, and in another neither bacteria nor spores were caught at 13,000 feet, it is thought very probable that viable micro-organisms are to be met with sometimes at considerably higher altitudes. Above 10,000 feet, however, the

air is relatively free from organisms. There was also evidence that micro-organisms are much more abundant in the air during summer than in the winter months, and that the clouds are more heavily charged with spores and bacteria than the air a little below them. The whole trend of the experiments suggested that air is the ideal medium for the transportation of these organisms, and that epidemics of plant and animal diseases may be brought about in this manner.

DUFRÉNOY (J.). **Les récentes études cytologiques relatives aux maladies à virus.** [Recent cytological studies on virus diseases.]—*Rev. Path. Comp. et Hyg. Gén., 1929,* 366–367, pp. 213–229, 8 figs., 1929.

In this paper the author gives a more detailed account than that recently noticed [*R.A.M.*, viii, p. 188] of his cytological studies of plants affected with virus diseases, and draws a brief comparison with the results obtained in the study of the virus diseases of animals.

The first symptom of virus infection in the cells of green plants is the appearance of a group of very small round or filamentous vacuoles; between these the cytoplasmic trabeculae are richly provided with mitochondria, which are generally short when near the small round vacuoles though often a filamentous mitochondrium borders a filamentous vacuole or is rolled round a spherical one. This close relation between the mitochondria and the vacuoles is characteristic of the initial phase of virus diseases.

In mosaic tobacco plants certain leaf areas show this first phase by a hypertrophy of the palisade cells, which become very rich in chloroplasts, and by the formation of numerous striate bodies in the cells of the hairs, the epidermis, or the parenchyma.

This stage of metabolic stimulation is succeeded by fragmentation and vesiculation of the mitochondria, and then by a series of changes ending in cellular plasmolysis. The plasmolysed cells often show a large phenolic spherical inclusion surrounded by a well defined membrane of precipitation. Round this inclusion, which corresponds to a large central vacuole, the cytoplasm contracts into a vacuolated mass attached by numerous cytoplasmic threads to the cellulose membrane. Some of these threads are clearly connected with the pits in the membrane, and form intercellular cytoplasmic communications.

During cellular degeneration the plastids produce numerous small lipoidal granulations. The dissociation of the lipoproteic complex of the plastid and the reabsorption of its mitochondrial substratum liberates these lipoidal granulations in the cytoplasm where they merge together into large globules.

HOGGAN (ISMÉ A.). **The Peach aphid (Myzus persicae Sulz.) as an agent in virus transmission.**—*Phytopath.*, xix, 2, pp. 109–123, 2 pl., 1 fig., 1929.

Extensive greenhouse trials [the results of which are tabulated and discussed] were made at the Wisconsin Agricultural Experiment Station to test the transmission of the viruses of tobacco and cucumber mosaic by the green peach aphid (*Myzus persicae*)

[*R.A.M.*, viii, p. 329]. This insect readily transmits the cucumber mosaic virus of J. Johnson's classification [ibid., vi, p. 501] from tobacco to certain Solanaceae that are known to be susceptible to both the viruses, viz., tobacco, *Nicotiana glauca*, *N. glutinosa*, *N. rustica*, *Capsicum annuum*, and *Physalis pubescens*. As compared with methods of artificial inoculation, the peach aphid was found to act as a highly efficient agent in the transmission of the cucumber virus. A definite selective action, suggesting that the relation between aphid and virus may not be purely mechanical, was observed in the transmission of this mosaic by *M. persicae*. Colonies reared on tobacco plants, infected with a mixture of cucumber and tobacco mosaic, transmit only the former from the combination, though the latter is present in the leaves on which the insects have fed.

Comparative trials, conducted under identical conditions, gave no evidence of transmission of the tobacco mosaic virus no. 1 of Johnson [loc. cit.] by the same aphid between the same host species, and *M. persicae* is not believed to be responsible for the transmission of ordinary tobacco mosaic in the field. These results appear to conflict with those reported by Allard (*U.S. Dept. of Agric. Bull.* 40, 1914; *Journ. Agric. Res.*, x, p. 615, 1917) on the ready transmission of tobacco mosaic in the greenhouse, but a possible explanation of the divergence is that this investigator was actually working, not with true tobacco mosaic, but with some other mosaic (possibly that of cucumber) on tobacco.

BAXTER (D. V.). **Mycorrhiza and Scotch Pine in the University of Michigan Forest Nursery.**—*Papers Michigan Acad. Sci. Arts and Letters*, ix, pp. 509–516, 4 pl., 1929.

In 1927 the writer detected the presence of *Rhizopogon rubescens* on the roots of Scotch pine (*Pinus sylvestris*) seedlings which had shown marked irregularity of growth during the previous season. The fungus (of which this is believed to be the first record on *P. sylvestris* in the United States) formed white mycorrhizal mantles on the lateral and tap roots, both of which forked dichotomously. A similar phenomenon was observed on Scotch and white pines [*P. strobus*] in Ohio. Pure culture experiments have been initiated to determine the exact relation of the mycorrhiza to the growth of the seedlings, but it is suggested that the irregularities observed may be due to the presence or absence of the fungus.

MATSUMOTO (T.). **The investigation of Aspergilli by serological methods.**—*Trans. Brit. Mycol. Soc.*, xiv, 1–2, pp. 69–87, 1929.

Some details are given of experiments carried out by the author with a view to determining to what extent the species and strains of *Aspergillus* can be differentiated by serological methods. In all, 23 species were tested with immune sera prepared from six species of the same genus. The most promising results were obtained with the complement fixation tests, which agreed in most important particulars with precipitation tests; the latter, however, are stated to have but little application to the classification of the fungi considered. Agglutination tests were entirely unsatisfactory. No precipitation was obtained with extracts of spores.

COONS (G. H.) & STRONG (MIRIAM C.). **New methods for the diagnosis of species of the genus Fusarium.**—*Papers Michigan Acad. Sci. Arts and Letters*, ix, pp. 65–88, 1 pl., 1929.

A description, accompanied by tables, is given of the results obtained in the writers' experiments in the application of a serological technique to the diagnosis of species of *Fusarium*. Anaphylactic reactions were secured with sensitized guinea-pigs, but the method was not found applicable to the problem under investigation. Complement fixation technique permitted the differentiation between closely related species (*F. radicicola*, *F. conglutinans*, *F. martii* [var.] *phaseoli*, *F. oxysporum*, and *F. orthoceras*). Reacting sera were obtained with either ground mycelial mats or mats peptized by selenium oxychloride, rabbits being sensitized with antigens prepared in this manner by giving them a series of intravenous injections at two-day intervals. After about 10 days the animals were bled and the serum tested against the homologous antigen and related forms. The method is believed to be too exacting to be widely used, but it may prove valuable in special investigations.

The triphenylmethane dyes, viz., rosaniline, malachite green, isamine blue, crystal violet, and brilliant green, in a synthetic medium gave promising results in the differentiation of some closely allied species, including *F. redolens*, *F. sclerotioides*, *F. vasinfectum*, *F. trichothecioides*, *F. discolor*, *F. eumartii*, *F. radicicola*, *F. coeruleum*, *F. zonatum*, *F. malli*, and *F. lycopersici*. Some species will grow at concentrations at which others fail to develop, the type of growth being sufficiently characteristic for diagnostic, though scarcely for taxonomic, purposes. The effect of the growth on the substratum varies with the species, a few (e.g., *F. radicicola*) producing strong decolorization of the medium containing the dye.

LA RUE (C. D.). **The effect of environmental factors on the spore size of Pestalozzia guepini.**—*Papers Michigan Acad. Sci. Arts and Letters*, ix, pp. 227–237, 1929.

The writer describes, tabulates, and discusses the results of his studies on the effect of temperature on growth, spore development, and spore size of two strains of *Pestalozzia guepini*, and on the effect of concentration of nutrients on the spore dimensions of three strains [*R.A.M.*, i, p. 452].

The habit of growth and rate of spore production were found to vary considerably on the different media, but (contrary to the results obtained by other workers on various genera) spore dimensions underwent no change in consequence of any of the environmental factors investigated. Mycelial production and the number of spores formed, but not their size, were decidedly affected by different temperatures. Thus, no sporulation occurred at 0° to 4° or at 37·5° C., whereas at 22° to 28° spore production took place in the normal way.

It is evident from these results that the reliability of spore measurements as a criterion for the delimitation of species will

depend largely on the constancy of spore size within a given group, and this character should, therefore, receive very careful consideration. It appears to be evident that fungi of different groups show a wide degree of variability in this respect.

SMITH (K. M.). **Studies on Potato virus diseases. IV. Further experiments with Potato mosaic.**—*Ann. of Appl. Biol.*, xvi, 1, pp. 1–33, 5 pl., 1929.

This is a detailed account of the author's experiments [a brief reference to which was made in a previous paper: *R.A.M.*, vii, p. 661] which showed that potato mosaic is readily transmissible to tobacco by means of needle inoculations or through the agency of the aphid *Myzus persicae*. On the two varieties of tobacco used—White Burley and Virginia—needle inoculations produced typical ring spot lesions [ibid., viii, p. 139]. On Virginia the usual symptom was the formation of well-marked rings, each with a central spot; the walls of the rings were sharply defined, necrotic, and whitish. On White Burley the disease was similar in general appearance, but differed in that, instead of the very clear-cut rings, it formed large numbers of round necrotic spots, only some of which approached a ring-like appearance. When transmitted by *M. persicae*, the potato mosaic produced on both varieties a characteristic spot and mottle disease. White Burley was the more susceptible to both forms of inoculation.

The needle-induced ring spot form in tobacco was easily retransmitted to potato (Arran Victory and President) by means of needle inoculation, while the aphid was able to do so only with great difficulty. The disease reproduced in the potato the original mosaic with the symptoms intensified and with the infective power greatly enhanced. This intensified form was easily transmissible to healthy potato plants by means of needle inoculation, but not by *M. persicae*. The same intensified form of mosaic was also produced in healthy potato plants by needle inoculations from tobacco plants infected by the aphid with the spot and mottle disease. The ring spot form was also shown to be transmissible from tobacco to tobacco both by needle and aphid, but when transmitted by the latter, the symptoms differ from those induced by needle inoculation.

Progressive inoculation through successive generations on tobacco plants increased the virulence of the ring spot form, the increase being greatest after passage through a host favourable to the development of the virus, such as the susceptible White Burley variety. In some cases the increase in virulence only reached a certain point, after which it tended to revert to its original intensity, but in others it reached an intensity sufficient to kill the host. As a rule, increased virulence of the virus in a given plant did not persist throughout the life of that plant.

Experiments made to test the effect of environmental conditions on the behaviour of the intensified virus in potato and tobacco showed that, while in the latter the symptoms are most apparent at a temperature of about 80° F., in the former they show best between 60° and 65°, indicating that optimum conditions for the host are also optimum for the virus. In tobacco local symptoms

often appear at the point of inoculation, but never in the potato, where the first symptoms always develop on the young leaves that appear subsequently. It was also shown that the tobacco ring spot virus and its counterpart in potato are filter-passing substances.

No pathological symptoms were produced in tobacco plants inoculated with juice from healthy potato plants. Neither was it found possible to infect healthy potato plants by means of inoculation with the body juices or salivary glands of insects that had been bred on mosaic potato plants. The tobacco ring spot virus produced mottling of the leaves when inoculated on tomato, mottling and some distortion of *Petunia* leaves, and mottling accompanied by large necrotic areas on the leaves of *Datura* sp., but failed to produce any symptoms on *Solanum nigrum*, spinach, and cabbage.

Lauer (K. W.). **Seed Potato certification in Pennsylvania.**—*Pennsylvania Dept. of Agric. Bull.*, xii, 2, 15 pp., 6 figs. [1 on cover], 1929.

Brief, popular notes are given on the work of seed potato certification in Pennsylvania, where the inspection service was first established in 1920. The general regulations, inspection requirements, and standard grades for seed potatoes are outlined, and the factors in production affecting certification are concisely explained. Some observations are made on the following diseases playing an important part in the acceptance or rejection of the crops submitted for inspection [cf. *R.A.M.*, vii, pp. 265, 533]: tipburn, early blight [*Alternaria solani*], leaf roll, mosaic, giant hill, *Rhizoctonia* [*Corticium solani*], blackleg [*Bacillus atrosepticus*], wilt [*Fusarium* spp. and *Verticillium albo-atrum*], and common scab [*Actinomyces scabies*].

Potato experiments, 1928.—*Govt. of Northern Ireland, Min. of Agric. Leaflet 7 (revised 1928)*, 13 pp., 3 figs., 1929.

Some details are given in the newly revised edition of this pamphlet [cf. *R.A.M.*, vii, p. 390] of further tests made in 1928 to ascertain the cropping qualities of new potato varieties immune from wart disease [*Synchytrium endobioticum*] in Northern Ireland. Outstanding in this respect was Arran Banner, a new early main-crop variety, which yielded, on an average, 19·7 tons per statute acre, and which is recommended for the replacement of the susceptible Arran Chief, as the tubers of both are similar in shape and of good cooking quality. It also proved to be the best yielder in variety tests, in which five new varieties, together with Up-to-Date, were tested alongside one another.

In a separate section descriptive notes are given of nine immune varieties tested in the scheduled districts [ibid., v, p. 64] and of the more important of the additional immune varieties tested at Stormont and Strabane.

Schlumberger [O.]. **Krebsfeste Kartoffelsorten.** [Wart-immune Potato varieties.]—*Deutsche Landw. Presse*, lvi, 5, p. 66, 1929.

Notes are given on some of the newly developed potato varieties found immune from wart disease [*Synchytrium endobioticum*] in the latest German official tests, and enumerated in a recent leaflet

issued by the Plant Protection Service. The number of such varieties is stated to have risen from 7 in 1921 to 75 in 1928, the corresponding figures for the susceptible ones tested being 98 and 187, respectively. In the 1928 tests the immune Erdgold, Cellini, and Ackersegen varieties proved useful substitutes for the susceptible Industrie; Trog's Tannenberg and Max Delbrück successfully replaced Parnassia and Deodara, respectively; while the late varieties Sickingen, Roland I, and Franz, though still scarcely equal to Wohltmann, also gave promising results [cf. *R.A.M.*, viii, p. 123].

WEIR (J. R.). **A blight of young buddings.**—*Quart. Journ. Rubber Res. Inst. Malaya*, i, 1–2, p. 118, 1929.

A blight of *Hevea* rubber buddings and seedlings associated with a species of *Phytophthora* and two other fungi is reported from three localities in Malaya and two in Sumatra. The disease first appears as a brown or black discoloration of the tip, which may spread downwards and destroy the shoot, though ordinarily extension is arrested when the older tissues of the bud patch and stock are reached. Damp weather favours infection, especially if the buddings are closely surrounded with a cover crop.

It is recommended that the diseased parts should be pinched off well below the affected tissues and burned, applications of Bordeaux or Burgundy mixture also being indicated.

BOBILIOFF (W.). **Onderzoekingen over de roode wortelschimmel bij Hevea.** [Investigations on the red root fungus of *Hevea*.] —*Arch. voor Rubbercult. Nederl.-Indië*, xiii, 2, pp. 98–117, 2 pl., 5 figs., 1 diag., 1929. [English summary.]

An investigation has been made of the occurrence and spread of the red root fungus [*Ganoderma pseudoferreum*: *R.A.M.*, viii, p. 226] in the *Hevea* rubber plantations of West Java, where severe damage may result from the attacks of this organism. In Central Java infection is also fairly prevalent, whereas in the eastern districts other fungi predominate.

It was observed that infection passes from the lateral roots of diseased trees to the tips of those of adjacent individuals. From the ends of the newly infected lateral roots the mycelium spreads to the tap root and thence to the other lateral roots. Generally speaking, the fungus is found only on roots in the soil and seldom occurs on exposed ones. Where the soil is partially washed away from the roots the hyphae become restricted to those parts which remain in contact with it. Numerous secondary roots develop on the dividing line between the decayed underground portions of the root system and the healthy parts exposed to the air.

Based on these observations, a new method of treatment has been developed to control the red root fungus by confining it to the lateral roots and thereby preventing its spread to the tap roots. The roots developing from the trunk are exposed over a radius of 50 cm., painted with a mixture of tar and asphalt (1 : 1), and subsequently re-covered with soil. This method is purely prophylactic and applicable only to trees situated round the centre of infection. Trees in an advanced stage of decay cannot be saved.

WEIR (J. R.). **The South American leaf blight and disease resistant Rubber.**—*Quart. Journ. Rubber Res. Inst. Malaya*, i, 1–2, pp. 91–97, 1929.

A brief account is given in popular terms of the South American leaf disease of *Hevea* rubber (*Dothidella* [*Melanopsammopsis*] *ulei*) [*R.A.M.*, vii, p. 114], the author urging that the introduction of the fungus into Malaya should be rigorously guarded against, as climatic factors and the almost continuous body of rubber in the Peninsula would greatly favour the dissemination of the disease; the development of resistant varieties of *Hevea* probably offers the best means of control [cf. ibid., iv, p. 309].

WEIR (J. R.). **Preliminary studies on some diseases of cover crops under Rubber in Malaya.**—*Quart. Journ. Rubber Res. Inst. Malaya*, i, 1–2, pp. 29–40, 1929.

Notes are given on three soil-borne diseases of cover crops under *Hevea* rubber in Malaya. *Vigna oligosperma* (*Dolichos hosei*) is liable to be killed out by *Sclerotium rolfsii*, the disease being conspicuous on this plant owing to its low growth and the thinness of the cover formed. The fungus also killed the young hypocotyl of germinating rubber seeds, a condition reproduced by inoculation.

Calopogonium mucunoides is frequently attacked by *Rhizoctonia* [*Corticium*] *solani* [cf. *R.A.M.*, iv, p. 638; v, p. 518]; this fungus is strongly parasitic on *Vigna* but under Malayan conditions does not grow well on *Hevea* rubber. Inoculation experiments with *C. solani* isolated from *V. oligosperma* showed that it can cause a collar rot of 5-days-old *Hevea* rubber seedlings.

Centrosema pubescens was found to be infected by a species of *Pythium* under damp conditions. The leaves and young stems were overrun by a fine white mycelium by which the rotted leaves remained suspended. Inoculations with pure cultures proved the fungus to be parasitic also on *Indigofera endecaphylla* and *V. oligosperma*.

The control measures suggested for these diseases consist in the isolation of infected patches by trenches, soil sterilization and disinfection, the more judicious selection of sites, the use of clean seed, rotation, and other improved cultural practices.

FULLERTON (R. G.). **Notes on defects in smoked sheet and crepe Rubber.**—*Quart. Journ. Rubber Res. Inst. Malaya*, i, 1–2, pp. 66–74, 1929.

Popular notes are given on some common defects of prepared rubber and their prevention by the use of antiseptics and improved methods of preparation. These defects comprise mouldiness of smoked rubber [*R.A.M.*, vi, p. 314]; bubbles in the latex or coagulum due to gaseous decomposition [ibid., vi, p. 183]; rustiness, attributed to the decomposition (produced by micro-organisms) of the serum substances which exude from the machined sheets [ibid., iv, p. 310]; spotting [caused mainly by bacteria and species of *Aspergillus*, *Penicillium*, and *Fusarium*; ibid., vi, p. 183] of crepe rubber; 'tackiness' or stickiness resulting from fermentative changes produced by contamination with organisms from the soil

or bark, or by exposure to light and heat, or by the presence of minute quantities of copper in the rubber; and yellowness, due to a vegetable pigment naturally present in the latex.

ZATTLER (F.). **Die Leistungen der Hopfenpflanzer in Bayern in den Jahren 1927 und 1928 auf dem Gebiete der Krankheits- und Schädlingsbekämpfung.** [The achievements of Hop planters in Bavaria during the years 1927 and 1928 in the field of disease and pest control.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, vi, 2, pp. 267–274, 1 diag., 2 maps, 1929.

Particulars are given of the Bavarian spraying campaign against the *Peronospora* disease of hops [*Pseudoperonospora humuli*: *R.A.M.*, vii, p. 398], the losses from which have been considerably reduced during the last two years as a result of preventive measures. Thus, in 1928 the average yield per hect. was about 11 cwt. compared with 8·10 cwt. in 1927 and 3·2 cwt. in 1926. The number of motor sprayers has increased from 313 in 1927 to 1,329 in 1928, the corresponding figures for ordinary movable and portable machines, respectively, being 5,142 and 2,337 compared with 3,166 and 2,358 in 1927. The average cost of these machines is R.M. 1,250, 170, and 70 for the motor, movable, and portable types, respectively.

KORFF (G.) & ZATTLER (F.). **Die Prüfung von Bekämpfungsmitteln gegen die Krankheiten des Hopfens im Jahre 1928.** [The testing of preparations for the control of Hop diseases in the year 1928.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, vii, 1, pp. 8–13, 1929.

In 1928 the downy mildew of hops (*Peronospora*) [*Pseudoperonospora humuli*: see preceding abstract] did not spread at all after the beginning of July and therefore no definite conclusion can be reached as to the respective merits of the various preparations used for its control. Neither kupferkalk Wacker (Dr. A. Wacker Werke G.m.b.H.) nor kupfernettolinkalkbrühe (Chemotechnik G.m.b.H., München) proved superior to the ordinary Bordeaux mixture within the limits of these preliminary tests.

PETRAK (F.). **Mykologische Beiträge zur Flora der kanarischen Inseln.** [Mycological contributions to the flora of the Canary Isles.]—*Bot. Jahrb.* (*Beibl.*), lxii, 3, pp. 49–124, 1928; 4, pp. 125–160, 1929.

In this paper the author enumerates about 100 species of fungi (mostly Ascomycetes and Deuteromycetes) from Madeira and the Canary Isles (chiefly Teneriffe). Few of the organisms listed appear to be of any economic importance. The new genera and species are accompanied by German diagnoses.

DA CAMARA (E. DE S.). **II. Mycetes in Laboratorio Pathologiae Vegetalis Instituti Agronomici Olisipponensis observata.** [II. Fungi studied in the Phytopathological Laboratory of the Lisbon Agricultural Institute.]—Reprinted from *Rev. Agron.*, *1929*, 1, 16 pp., 3 pl., 1929.

The following records are of interest in this list of 15 fungi from

the island of St. Thomas [Gulf of Guinea]: *Leptosphaeria almeidae* n.sp. on the leaves of *Cinnamomum zeylanicum*; *Macrophoma superposita* n.sp. on pineapple leaves; *M. sycophila* (Mass.) Sacc. et D. Sacc. on the leaves of *Ficus elastica*; *Phyllosticta polypsecadiospora* n.sp. on the leaves of *Anona muricata* in association with *Zygosporium oscheoides* and an undetermined Ascomycete; *Colletotrichum violae-tricoloris* R. E. Smith on the leaves of *Viola odorata*; *Gloeosporium ricini* on the stems of *Ricinus communis*; *Marsonia* [*Marssonina*] *agaves* Earle on the leaves of *Agave rigida* var. *sisalana*; *Pestalozzia funerea* on pineapple leaves in conjunction with an undetermined Hyphomycete; and *Ellisiella trichocampta* n.sp. on the leaves of *Bougainvillea* sp. Latin diagnoses of the new species are given. The following were found on the bark of cacao trees: *Zignoella buttneri* Rehm (?) a Latin description of which is given, *Melanomma henriquesianum* Bres. et Roum., *Pleospora infectoria*, and *Polylagenochromatia theobromae*, n.g., n.sp. (a genus differing from *Polystigmina* by its occurrence on branches).

LIENEMAN (CATHARINE). **A host index to the North American species of the genus Cercospora.**—*Ann. Missouri Bot. Gard.*, xvi, 1, pp. 1–52, 1929.

This list of 516 species of *Cercospora* occurring in North America is first arranged according to the hosts and then according to the fungi, in alphabetical order. In the latter list there are brief literature references. The paper comprises also an introductory note with a diagnosis of the genus, a short account of its history, and an explanation of the nomenclature used.

ASHBY (S. F.). **Strains and taxonomy of Phytophthora palmivora Butler (P. faberi Maubl.).**—*Trans. Brit. Mycol. Soc.*, xiv, 1–2, pp. 18–38, 9 figs., 1929.

The investigation reported at some length in this paper was intended to determine in how far Gadd's observations of the morphology and biology of the strains of *Phytophthora palmivora* isolated by him in Ceylon [*R.A.M.*, iv, p. 65] are applicable to isolations made elsewhere from the same and other host plants. As many isolations in pure culture as possible were procured, and grown on standard media such as bean meal, quaker oats, and maize meal agars. The results showed that the cultures fell into two groups, one of which was considered to be typical of the species, and the other atypical, the latter being distinguished by a marked reduction in, or almost complete suppression of, the production of sporangia, a frequently more abundant growth of aerial mycelium, and a free and rapid development of chlamydospores. The typical strains, characterized by an early and abundant production of sporangia, were those isolated from coco-nut in Jamaica and India, cacao in Trinidad, Grenada, Jamaica, and the Gold Coast, cotton in St. Vincent, *Mimusops* sp. in the Gold Coast, *Hevea* rubber in Ceylon and Malaya, and citrus in the Philippines. Most of the atypical cultures examined were obtained from 'culture collections' maintained for some years, and included isolations

from coco-nut and cacao in the Philippines; cacao, breadfruit (*Artocarpus incisa*), and *Dendrobium* sp. in Ceylon; *Vanda* sp. and *Cattleya* sp. in Java; coco-nut and Sabal palm in Porto Rico; and cacao in Surinam.

While noting the great sensitiveness of the sporangia and chlamydospores of all the strains to external conditions, humidity, nature of substratum, and age of culture, all of which appreciably affect their size and shape, it is stated that these organs in a number of isolations, when grown under comparable conditions on standard media, retain some degree of morphological stability.

In a wide range of experiments, in which strains of *P. palmivora* were grown in pairs on slants of maize meal-agar at moderate temperatures (20° to 25° C.), some pairs, within a week, freely produced amphigynous sexual organs with oospores having a mean diameter between 22 and 24 μ in the zone of contact of the two growths, while in other pairs oospores were not formed even after several months. The reaction, when it occurred, was prompt and definite with both typical and atypical cultures, and allowed of separating the strains into two groups which, in agreement with Gadd [loc. cit.], are designated as the 'cacao' and 'rubber' groups, respectively. The arrangement of the strains tested in the two groups is given in a table, and the morphology of the oospores observed is described at some length.

In discussing the taxonomy of the fungus, the author states that no doubt can any longer exist of the identity of *P. palmivora* and *P. faberi*, and as Butler's binomial antedates Maublanc's by two years, the name proposed by the latter must be abandoned. Furthermore, since Coleman's binomial *P. theobromae* was withdrawn by him on recognizing the priority of Maublanc's name, all the strains of the organism must be referred to *P. palmivora* Butler, with *P. faberi* Maubl. and *P. theobromae* Colem. as synonyms. An emended description of the species is given.

In an additional note to this paper, it is stated that the strain isolated by McRae from bud rot of the palmyra palm in the delta of the Godavari was shown in paired cultures to belong to the 'cacao' group. Atypical pure cultures of a strain isolated from coco-nut in the Philippines and of one from cacao in Surinam, each from a single hypha or spore, which were sent for examination by Tucker from Porto Rico [ibid., viii, p. 428], were found to contain oogonia and oospores. When tested in paired cultures, one was found to belong to the 'rubber' and the other to the 'cacao' group.

BUDDIN (W.) & WAKEFIELD (ELSIE M.). **Further notes on the connection between Rhizoctonia crocorum and Helicobasidium purpureum.**—*Trans. Brit. Mycol. Soc.*, xiv, 1–2, pp. 97–99, 1929.

Further support for the view previously expressed by the authors of the genetic relationship between *Rhizoctonia crocorum* and *Helicobasidium purpureum* [*R.A.M.*, vi, p. 756] was supplied by Ware's record of the occurrence of both fungi in association on black medick (*Medicago lupulina*) [see above, p. 510] and Watson's similar record on the roots of Sitka spruce (*Picea sitchensis*) [ibid.

viii, p. 280]. Nine of the ten Sitka spruce seedlings examined by them had their collar encircled by the fructification of *H. purpureum*, and the connexion of this with the mycelium of *R. crocorum* on the roots below was unmistakable. Cultures raised from the infection cushions of *R. crocorum* on the roots of black medick material supplied by Ware, and from *H. purpureum* from the same host, agreed in their general behaviour with isolations previously obtained from other hosts. When tested in 1927 for their pathogenicity to carrots and mixed clovers in pots, the isolations of *R. crocorum* gave roughly 50 per cent. infection on the former, but much less on the latter, while cultures derived from spores of *H. purpureum* did not give rise to any infection. A strain of *R. crocorum* isolated from cotton in Trinidad which was tested at the same time, failed to infect both carrots and mixed clovers, but is interesting in that, after some weeks of subculturing, it produced pustules of *Tuberculina*-like conidia, exactly resembling those already described in the authors' earlier paper.

These results support the opinion that strains of *R. crocorum* from different hosts vary considerably in virulence. It was particularly noted that strains which produce conidia appear to be less strongly parasitic than those that do not, since successful infections have, up to the present, only been obtained with spore isolations from cultures that did not produce any conidia. In their final conclusion the authors state that the evidence recorded in this paper leaves no doubt that *H. purpureum* is the perfect stage of *R. crocorum*.

PAUL (W. R. C.). **A comparative morphological and physiological study of a number of strains of Botrytis cinerea Pers. with special reference to their virulence.**—*Trans. Brit. Mycol. Soc.*, xiv, 1–2, pp. 118–135, 1 pl., 1 fig., 1 graph, 1929.

Preliminary work [a brief outline of which is given] indicated that strains of *Botrytis cinerea* can be distinguished, on the ground of their growth habit in culture, into three groups, namely: one with a strongly marked tendency to form sclerotia; the second with a general tendency to form aerial mycelium; and the third characterized by its freely sporing habit. The purpose of the ensuing investigation was to make a comparative study of a strain representative of each of the above groups (which, for the sake of brevity, are referred to as *Sc*, *M*, and *Sp*, respectively) to determine the limits of their morphological variability on different media and under varying environmental conditions, their relative parasitic activity on a number of host plants [a list of which is given], and lastly, to correlate the different degrees of parasitism with certain physiological features of the strains.

The general growth tendencies of the strains were, for the most part, maintained on all the media tested, although there were some variations from medium to medium in the intensity of their development. High atmospheric humidity appears to favour the formation of sclerotia and to decrease the tendency to sporulation, a similar effect being apparently produced by absence of light. On all the media, except Coons's agar, strains *M* and *Sp* showed very similar rates of growth at various temperatures, while strain *Sc*

grew much more slowly. The optimum temperature for growth for the three strains was between 21° and 25° C., probably nearer the latter temperature. Strain *Sp* differed from the others in the size and shape of its spores, which were more elliptical.

Inoculation experiments indicated that strain *M* is the most actively parasitic of the three, but no evidence of selective parasitism was obtained. No correlation could be established by physico-chemical tests between the varying degrees of virulence and the varying capacities of the strains for secreting pectinase. There was also no indication that the difference in parasitic activity of the strains can be explained on the basis of different powers of mechanical penetration by the hyphae, as when tested on a series of formalized gelatine membranes of graded hardness, all possessed approximately the same penetrative power.

NISIKADO (Y.). **Studies on the Helminthosporium diseases of Gramineae in Japan.**—*Ber. Ōhara Inst. Landw. Forsch.*, iv, 1, pp. 111–126, 9 pl., 1929.

This is an English summary of the writer's Japanese paper describing his investigations on the *Helminthosporium* diseases of Gramineae in Japan, originally published in the *Special Rept. Ōhara Inst. Agric. Res.*, 4, 384 pp., 62 pl., 20th December, 1928.

Twenty-four species of *Helminthosporium* parasitic on eight species of cereals and eighteen of wild grasses were studied on their hosts and in culture, and the following seven types of symptoms produced by them are distinguished: leaf stripe, leaf or eye spot, net blotch, leaf blight, foot rot, sooty heads, and black knots.

The author proposes the division of the graminicolous species of *Helminthosporium* into two sub-genera, viz., *Eu-Helminthosporium*, characterized by fusiform conidia germinating from the polar cells; and *Cylindro-Helminthosporium*, distinguished by cylindrical conidia germinating both from the polar and the intermediate cells. The diagnoses of these two sub-genera, with the species in each, are given in the subjoined key. The ascigerous stages hitherto discovered in *Eu-Helminthosporium* belong to the genus *Ophiobolus*; only three have so far been determined, viz., *O. heterostrophus*, *O. miyabeanus*, and *O. kusanoi* [*R.A.M.*, viii, p. 439]. The ascigerous stage of the sub-genus *Cylindro-Helminthosporium* belongs to *Pyrenophora* (or *Pleospora* of some authors), and is represented by *P. bromi*, *P. tritici-repentis*, and *P. teres* [ibid., iii, p. 66].

The optimum temperature for conidial germination in *H. oryzae* [ibid., viii, p. 263] was found to be 25° to 30° C., with a maximum and minimum at 41° and 2°, respectively. The optimum temperature for the mycelial growth of a large number of species of *Helminthosporium* appears to be 28° to 30°, but *H. brizae* n. sp., *H. gramineum*, *H. leersii*, and *H. tritici-vulgaris* [ibid., viii, p. 164] grew best at or slightly below 28°; *H. catenarium*, *H. maydis*, and *H. setariae* at or just above 30°. The conidia of many of the species investigated were killed by five minutes' immersion in hot water at 54° to 56° or by ten minutes at 52° to 54°. The conidia

of *H. turcicum* [ibid., vi, p. 547] produced at comparatively low temperatures (15° to 20°) were exceptionally large and broadly fusiform, tapering with rising temperatures and becoming irregular above 30°. In *H. maydis,* on the other hand, the conidia produced at 15° were relatively small and straight-cylindrical, becoming crescent-shaped at 23° to 30° and irregular at 33°. Little difference was observed between these two species as regards septation at 15°, but at 27° to 30° they differed considerably.

The effect of temperature during the germination of barley on the occurrence of stripe disease (*H. gramineum*) was also investigated. Infection was severe when the seedlings germinated at relatively low temperatures (up to 20°) but apparently did not occur above this point [cf. ibid., v, p. 545].

Many of the species studied began to grow at a hydrogen-ion concentration of P_H 3·6 on rice decoction agar (very rarely at P_H 2·6) and continued up to P_H 10·9, with an optimum between P_H 6·7 and 8·7. Experiments showed that the hydrogen-ion concentration of the leaf juice of numerous commonly cultivated rice varieties ranges from P_H 5·0 to 6·8 (mostly 6·0 to 6·5). Plants grown in sand cultures at an acid concentration above P_H 5·0 were more susceptible to leaf spot (*H. oryzae*) than those maintained in an alkaline solution (P_H 7·0).

The writer observed that *H. teres* produces catenulate secondary conidia both in nature and in culture.

The species studied all remained viable for relatively long periods (940 days in the case of *H. oryzae*). The germ-tubes are covered with mucilage and form appressoria at the tip, by means of which they adhere to the surface of the host and penetration is aided. Inoculation experiments showed that a large number of Gramineae are susceptible to infection by several species, *H. oryzae,* for instance, attacking the leaves of over 25 species. Extensive laboratory and field experiments denote that both *H. oryzae* and *H. gramineum* may be practically eliminated by seed treatments [ibid., vii, p. 504].

English diagnoses are given of the following new species described by the author in this paper (as well as of *H. brizae* on *Briza minor*, *H. miyakei* on *Eragrostis pilosa*, and *H. zizaniae* on *Zizania latifolia*). *H. panici-miliacei*, forming long-elliptical or fusiform lesions on the leaf blades and sheaths of *Panicum miliaceum*, has dark olive-green conidiophores, 75 to 255 by 7·65 to 10·20 μ (179·5 $\pm$ 2·30 by 8·22 $\pm$ 0·04 μ), with 2 to 10 (average 6·4 $\pm$ 0·08) septa, bearing 1 to 6 (2·68 $\pm$ 0·06) conidia, the first 75 to 135 μ from the base, with moderate geniculations at the scars; the conidia are dark olive, fusiform, with wide central cells gradually tapering towards both ends, sometimes slightly curved to one side, and measure 30·6 to 155·5 by 10·2 to 26·8 μ (102·42 $\pm$ 0·33 by 19·18 $\pm$ 0·04 μ), with 1 to 12 (6·83 $\pm$ 0·02) septa.

H. yamadai forms ovoid or oblong brown lesions with irregular concentric zones on the leaf blades and sheaths of *P. miliaceum*. The conidiophores measure 100 to 200 μ (sometimes up to 500 μ) and bear 1 to 6 brown or olive, cylindrical, fusiform, or obclavate, straight or curved conidia measuring 35·7 to 160·8 by 10·2 to 25·5 μ (78·68 $\pm$ 0·39 by 16·93 $\pm$ 0·05 μ), with 3 to 11 (7·21 $\pm$ 0·03) septa.

H. coicis forms brown or yellowish-brown, fusiform lesions on the leaf-blades, sheaths, and fruits of *Coix lacryma-jobi* var. *typica* and causes the premature death of the leaves. It has simple, straight, relatively thick-walled, dark brown or dark olive conidiophores, measuring 50 to 180 by 6·4 to 8·5 μ (117·20 $\pm$ 2·16 by 7·24 $\pm$ 0·05 μ), and brown or dark olive, short fusiform or irregularly ovoid, curved conidia, 25·5 to 73·95 by 11·5 to 22 μ) (47·13 $\pm$ 0·22 by 16·68 $\pm$ 0·04 μ), with 2 to 7 (4·20 $\pm$ 0·02) septa. In all three species the hilum is located internally.

GADD (C. H.). **Rhizoctonia bataticola and Tea root diseases.**—*Trans. Brit. Mycol. Soc.*, xiv, 1–2, pp. 99–109, 1929.

After briefly summarizing Small's views on the part played by *Rhizoctonia bataticola* (*Macrophomina phaseoli*) in the causation of root diseases of woody plants in the Tropics [*R.A.M.*, vii, p. 603 *et passim*], the author proceeds to discuss them in some detail in as far as they apply to tea in Ceylon, a crop with which he is intimately acquainted. In his opinion Small's statement that on this host *R. bataticola* must be regarded as the primary pathogenic agent which prepares the way for other fungi, the latter only being secondary organisms, is unsupported by any experimental evidence or by field observations. Nor is it supported by the statistical figures of tea root diseases supplied by Small himself, since of 263 cases examined by him in 1926, only 146 were clear cases of attack by *R. bataticola* alone, while in 66 cases this fungus did not occur at all, the organisms responsible for the condition being *Poria hypolateritia*, *Fomes lamaoensis*, *Ustulina zonata*, *Rosellinia arcuata*, and *Botryodiplodia theobromae*, respectively. These figures, furthermore, do not represent correctly the incidence of tea root diseases in Ceylon, as the majority of the cases were sent in for examination from a small area on the Peradeniya Experiment Station, on which the bushes had died after pruning.

The author further points out that the *P. hypolateritia* and *R. arcuata* diseases in tea usually occur in patches, spreading outwards from a centre and leaving large bare areas after the removal of the dead bushes. Unless the diseases are checked in good time, the affected areas become larger from year to year, with dead and dying bushes on their perimeters. The spread of these fungi is so characteristic that it is often possible to state with certainty that one of them is concerned before the bush is uprooted for examination. On the other hand, Small admits that so far no proof has been obtained that *R. bataticola* can spread in the soil by contact.

After a brief reference to Small's claim that *R. bataticola* has been found to kill tea seedlings in nurseries, which is contested, and to the identification by Park of *R. bataticola* as a mycorrhizal fungus of tea in Ceylon [ibid., vii, p. 604], the author concludes that, even on the facts adduced by Small, it cannot be maintained that *R. bataticola* is often the sole cause of root disease in tea, while all the present evidence tends to show that there is no reason to suppose that it ever causes a pathological condition of this plant.

VINSON (C. G.) & PETRE (A. W.). **Mosaic disease of Tobacco.**—*Bot. Gaz.*, lxxxvii, 1, pp. 14–28, 1929.

This is the full description of the physico-chemical methods adopted in separating the virus from the juice of mosaic-diseased tobacco plants, the essential points of which have been already noticed [*R.A.M.*, vii, p. 277; viii, p. 407].

HOLMES (F. O.). **Local lesions in Tobacco mosaic.**—*Bot. Gaz.*, lxxxvii, 1, pp. 39–55, 7 figs., 4 graphs, 1929.

Five species of *Nicotiana*, namely, *N. rustica*, *N. langsdorffii*, *N. sanderae*, *N. acuminata*, and *N. glutinosa*, were found invariably to develop well-defined local lesions on their leaves, following successful inoculation with the virus of the common field type of tobacco mosaic by the method described by the author in a previous paper [*R.A.M.*, viii, p. 138]. The lesions, which are in the form of necrotic spots of varying colour in the five species, were shown in subsequent experiments [brief details of which are given] to be well adapted to serve as indicators of the virulence and concentration of samples of tobacco mosaic virus, especially on *N. rustica*, owing to the large size of its leaves, and on *N. glutinosa*, owing to the exceptionally short time (from three to five days) the spots take to develop on this species. Since it was shown that the number of lesions developing on the leaves is in direct proportion to the concentration of the virus in the inoculum, it is believed that a standardized method for using *N. glutinosa* as a test plant in measuring the concentration of mosaic virus will give as rapid and as accurate results as the determination of bacterial numbers by plating methods.

HOLMES (F. O.). **Inoculating methods in Tobacco mosaic studies.**—*Bot. Gaz.*, lxxxvii, 1, pp. 56–63, 4 figs., 1929.

Continuing his studies on the artificial transmission of tobacco mosaic [see preceding abstract], the author briefly describes a series of experiments with *Nicotiana rustica*, the results of which showed that the most effective way of inoculation consists in gently rubbing over the surface of a large leaf with a cheesecloth soaked in the extract containing the virus. There was evidence that the entry of the virus occurs instantaneously when a lesion is made in this manner on the surface of the leaf in the actual presence of the virus, while when scratches or pin pricks were made previous to (or even, in a somewhat lesser degree, after) the application of the virus, the results of the inoculation were frequently negative. Immediate removal by washing of the excess inoculum applied by the first method did not decrease the total number of infections, but in some cases actually increased it.

McMURTREY (J. E.). **Effect of mosaic disease on yield and quality of Tobacco.**—*Journ. Agric. Res.*, xxxviii, 5, pp. 257–267, 5 pl., 1 fig., 1929.

A brief outline is given of experiments (with the Maryland Broadleaf variety of tobacco) conducted from 1925 to 1927, in-

clusive, in Maryland, to determine the effect on the yield and quality of tobacco of mosaic disease, which is stated to be very prevalent in the south of the State. The results showed that both yield and quality are very adversely affected, especially when infection takes place early in the season, the chief defects of the cured leaves from mosaic plants consisting in dwarfing, some discoloration (but not in the distinct patterns observed on the green leaves), and necrotic spots of the same type as those found on living leaves.

Under the conditions of the tests, inoculation at transplanting time resulted in an average reduction in yield of 30 to 35 per cent., while the estimated gross value of the crop per acre was reduced by over 55 per cent. The damage was almost as severe when the plants were inoculated a month after transplanting. The yield was not significantly reduced by inoculation at topping time, but the quality was appreciably lowered by the development of mosaic following even this late inoculation.

VERWOERD (L.). **On two cases of recovery from a mosaic disease of Tomato plants, Lycopersicum esculentum.**—*Ann. of Appl. Biol.*, xvi, 1, pp. 34–39, 1929.

Some details are given of an experiment made at the end of 1927, in which two of a number of cuttings taken from a badly mosaic-diseased tomato plant, when planted at Stellenbosch, Cape Province, developed into healthy plants and produced normal fruit, while four other cuttings continued to show the mosaic, and the remainder failed to root. In order to test whether mosaic was not latent in the first two plants, juices from them were inoculated into 90 healthy tomato plants of the Bonnie Best variety with negative results, and insertion of fragments of their tissues into a further series of 40 plants also failed to produce infection. Four cuttings taken from one of these plants also grew into healthy plants. From these facts it is concluded that these two mosaic-free tomato plants raised from diseased cuttings represent cases of true recovery from the disease.

DÖRING (E.). **Bekämpfung von Phytophthora infestans an Tomaten in geschlossenen Kulturräumen durch unterirdische Bewässerung.** [Control of *Phytophthora infestans* on Tomatoes in closed glasshouses by subterranean irrigation.]—*Obst- und Gemüsebau*, lxxv, 3, pp. 49–51, 2 diags., 1929.

Attempts have been made in the Essen district of Germany to check late blight of tomatoes (*Phytophthora infestans*) by means of subterranean irrigation, thereby avoiding the wetting of the leaves which provides the best condition for the germination of the spores. The method, however, has not been successful, owing to defects in the construction and installation of the pipes which prevented the even distribution of the water. Suggestions are given for improvements in the technical arrangements which it is believed would remedy these deficiencies and facilitate control.

RAMSEY (G. B.) & BAILEY (ALICE A.). **Development of nail-head spot of Tomatoes during transit and marketing.**—*Journ. Agric. Res.*, xxxviii, 3, pp. 131–146, 1 pl., 8 graphs, 1929.

This is the full account of the authors' investigation of the development in transit and during marketing of nailhead spot of tomatoes [*Macrosporium tomato*], an abstract from which has already been noticed [*R.A.M.*, vi, p. 449]. Besides appreciably reducing the market value of the fruit attacked, the disease is also important in that the lesions afford easy access to secondary organisms which rapidly decay the tomatoes.

The results of observations and experiments made from 1925 to 1927 showed that infection with *M. tomato* is correlated with maturity of the fruit, and not with its size, although most infections occur on the smaller tomatoes. The rate of development of nailhead spot is more rapid in green tomatoes and decreases uniformly as the fruit ripens. Counts and measurement of the spots made at shipment in Florida and on arrival in Chicago showed that new nailhead spots may be formed during transit on tomatoes of any commercial size (but chiefly on those averaging from 2 to 2·5 inches in diameter), the percentage of new infections being dependent on the maturity of the fruit shipped and on variations in seasonal conditions. The average diameter of the new spots that developed during the experiments was 1·4 mm. These new spots were flat, somewhat irregular in outline, tan in colour, and only skin deep. They enlarged more rapidly in transit and during subsequent storage than those which were present on the fruit at shipment. The rate of development of the latter was inversely proportional to their original size, the average daily growth in diameter being from 0·02 mm. for the 5 mm. spots to 0·25 mm. for those newly formed. It was also shown that the rate of growth of the spots slows down as their size increases, and practically ceases when they reach a diameter of 3 mm.; spots over this size were observed in less than 10 per cent. of all the cases investigated, while spots over 6 mm. in diameter were very rare.

Tomato leaf-mould disease.—*Min. of Agric. and Fish. Leaflet* 262, 6 pp., 1 pl., 1929.

A brief popular account is given of the leaf mould disease (*Cladosporium fulvum*) of tomato [*R.A.M.*, viii, p. 342], which is stated to be a very common and serious trouble of the crop under glass in Great Britain, especially under conditions of high temperature and excessive atmospheric humidity. Recommendations are made for the control of the fungus, including regulation of temperature and humidity in the glasshouses, and vaporizing, spraying, or dusting the plants with sulphur fungicides. Copper carbonate solution in ammonia is the only copper fungicide recommended. Some named varieties have shown considerable resistance to the disease, but do not possess desirable commercial qualities. It is, however, believed that varieties may be bred from the existing material both for resistance and good quality of produce.

LEGAT (C. E.). **Annual Report of the Chief Conservator of Forests.**—*Ann. Rept. South Africa Dept. of Forestry for the year ended 31st March, 1928*, 32 pp., 1929.

The following references of phytopathological interest occur in this report. An obscure fungous disease continued to spread among the *Pinus insignis* stands of the Knysna district (Natal), and will form the object of a thorough mycological investigation under the auspices of the Stellenbosch-Elsenberg College of Agriculture. *P. insignis* was also severely damaged in the Jessievale plantation (eastern Transvaal) by the attacks of *Diplodia pinea* following hailstorms. Attempts to raise transplants of *Eucalyptus altior* and *E. gigantea* were unsuccessful owing to heavy infection by an unidentified fungus. *E. gigantea* in three nurseries of the Natal Conservancy also suffered from a disease of undetermined origin. Damping-off of pines [(?) *Pythium de Baryanum*] was reported as troublesome from the Transkeian Conservancy.

GRAVES (A. H.). **Forest pathology.**—*Eighteenth Ann. Rept. Brooklyn Bot. Gard., 1928* (*Brooklyn Bot. Gard. Record*, xviii, 2), pp. 57–59, 1929.

Arrangements are in progress for the testing of a number of Chinese and Japanese chestnut trees (*Castanea mollissima* and *C. japonica*) for resistance to blight [*Endothia parasitica*: *R.A.M.*, vii, pp. 606, 685].

The oak twig blight, described by Miss Ingram (*Journ. Agric. Res.*, i, p. 339, 1914) as occurring on white oak (*Quercus alba*) and other species of oak and chestnut (*Castanea dentata*), is stated to be very prevalent on chestnut oak (*Q. montana*). The young shoots wilt and turn brown, and fully developed leaves may be indirectly killed by infection of the twigs bearing them. Such leaves turn light brown and form a striking contrast to the healthy green of the rest of the foliage. Usually the damage is slight, but in cases of continuous attacks large trees may gradually succumb, while small suppressed individuals in the forest often die from this cause. *Diplodia longispora* was found in all the diseased material examined, and is believed to be the cause of the disease, but insect injury may also contribute to the development of the symptoms.

BOYCE (J. S.). **The future of forest parasites in the United States.**—*Journ. of Forestry*, xxvii, 2, pp. 138–142, 1929.

The author draws attention to the serious potential danger to American forests from the introduction of parasitic fungi on imported nursery stock, and emphasizes the importance of strict quarantine regulations and prompt defensive measures. He points out that whereas an introduced parasite may, from a commercial point of view, threaten the extinction of a tree species, a native parasite never does so, and that while the latter is, in most cases, controllable by proper silvicultural practice, this offers little hope of exterminating such introduced diseases as chestnut blight (*Endothia parasitica*) or white pine blister rust (*Cronartium ribicola*). He considers that the importation of foreign nursery stock is a

most dangerous practice, and that foreign tree species should be introduced only as seed. Stress is laid upon the importance of carefully studying foreign fungi in the countries in which they are found, and comparing them with similar native species, in order that, if control measures become necessary, they may be applied without loss of time.

WOLLENWEBER (H. W.). **Das Ulmensterben.** [The die-back of Elms.]—*Blumen- und Pflanzenbau*, xliv, 3, pp. 40–41, 3 figs., 1929.

This is a popular account of the author's researches in connexion with the die-back of elms caused by *Graphium ulmi* [*R.A.M.*, viii, p. 343].

NUTMAN (F. J.). **Studies of wood-destroying fungi. I. Polyporus hispidus (Fries).**—*Ann. of Appl. Biol.*, xvi, 1, pp. 40–64, 3 pl., 2 figs., 1929.

While in America *Polyporus hispidus* occurs on the black ash (*Fraxinus nigra*) almost exclusively and is not known to attack white ash (*F. excelsior*), in Great Britain it is common on both species, but owing to the great predominance of the latter, is chiefly important as causing a decay of this tree. The characters of the decay in white ash are very similar to those described by Baxter in black ash [*R.A.M.*, iii, p. 497]. The source of infection is usually the stub of a dead branch, from which the rot spreads up and down the tree to a considerable distance. While usually saprophytic in the heart wood, the author's inoculation experiments showed that it is able to penetrate and grow slowly in the living tissues of the sapwood. From an economic point of view the fungus is mainly interesting through its suspected connexion with the brittle condition of ash timber known in trade under the term 'brashness', as samples of wood giving a 'brash' fracture but otherwise anatomically indistinguishable from wood of high strength, in every instance contained very sparsely but evenly distributed hyphae of a fungus. The latter failed, however, to develop in culture, probably because it had died out in the seasoned timber.

A detailed description is given of the cultural characters of *P. hispidus* on various solid and liquid media. Among the latter, the fungus grew best on turnip extract, on which, in one case, it produced a well-defined but sterile fruit body, 4 by 3 inches in surface area and 2 in. thick, the pore surface being about 3 by 2·5 in. On sterilized blocks of ash wood incubated at 25° C. it caused a rot indistinguishable from that occurring in nature. In the early stages the fungus apparently made its greatest development in the medullary rays and in the xylem parenchyma, and penetrated the cell walls almost exclusively through the pits. At the end of six months, the vessels were choked with a thick weft of mycelium, and the medullary rays and xylem parenchyma were full of hyphae which bored freely through the cell walls, without reference to the position of the pits. The bore holes were frequently formed in rows down a cell wall by a single hypha winding in and out of it. In no case were clamp-connexions, medallion hyphae, or 'buckles' found. Under the conditions of the experiment the rate of pene-

tration of the fungus in the ash wood blocks was 0·5 cm. per month across the growth rings, and at least 7 mm. per month in a direction parallel to the grain.

Details are also given of the enzymes produced by the mycelium of *P. hispidus*, and particularly of a method evolved for demonstrating the presence of a ligninase, which is a modification of Czapek's 'hadromal' reaction. So far the following enzymes have been demonstrated: emulsin, diastase, invertase, ligninase, hemicellulase, oxidase, and catalase.

HARTLEY (C.) & HAASIS (F. W.). **Brooming disease of Black Locust (Robinia pseudacacia).**—*Phytopath.*, xix, 2, pp. 162–166, 2 figs., 1929.

A witches' broom disease of black locust (*Robinia pseud-acacia*) has been observed in different parts of the Appalachian Mountains for a number of years, but hitherto no report of investigations on the cause of the condition appears to have been published.

The symptoms frequently occur on sprouts arising from the roots and stumps of cut trees. In some cases the entire sprout is a broom, forming a low plant with minute leaves, but more often the brooms develop terminally or in axils of normal leaves near the top of the sprout. The brooms are so numerous on diseased trees as to suggest systemic rather than local infection. The pale dwarf disease of *Arachis hypogaea* [*R.A.M.*, vi, p. 651] has some resemblance to the witches' broom of *R. pseud-acacia* in the reduced size and clustering of the leaves, while there are also apparently systemic witches' broom diseases known in Java as 'krulziekte' [ibid., vii, p. 380] of *A. hypogaea*, *Phaseolus mungo*, *Crotalaria verrucosa*, and *Dolichos biflorus*; these were described by Rutgers (*Dept. Landb., Nijv. en Handel, Inst. Plantenziekten Meded.* 6) in 1913. In 1922 one of the writers received a much proliferated terminal broom of *C. juncea* from Java, where 18 per cent. of a planting were reported to be affected and producing no seed.

It is suggested that the witches' broom of the black locust may be a systemic virus disease possibly allied to those of other Leguminosae, as no evidence has been obtained that it is caused by visible parasites or by insects.

MALYCHEV (M. N.). **Les conditions de la germination des spores du champignon Dasyscypha willkommii.** [The conditions of spore germination in the fungus *Dasyscypha willkommii*.]——*Rev. Gén. de Bot.*, xli, 483, pp. 185–190, 1929.

In a series of cultural experiments [the results of which are summarized and tabulated] with the causal organism of larch canker (*Dasyscypha willkommii*) [*R.A.M.*, viii, p. 2], the author found that the percentage of spore germination is generally very low (5 per cent. or less); however, on agar with the addition of extract from the cortex of fresh larch branches or of 25 to 30 per cent. glycerine, 20 per cent. germination was obtained.

Germination proceeds slowly in *D. willkommii*, seldom being completed before the 14th to 30th day after sowing the spores. The spores do not germinate at room temperature during the months of November, December, and January, but germination

takes place when the cultures are maintained in the incubator at 25° to 37° C. on the above-mentioned media. Light was found to exercise no influence on the process of germination.

The spores of *D. willkommii* do not germinate in water, whether on a slide or in hanging drops; on pure agar (1 to 2 per cent.); or on agar with the addition of extract from the cortex of dead larch branches. Germination occurs on an agar medium with the addition of 7 to 13 per cent. saccharose, but less profusely than with glycerine (the concentration of which should not fall below 13 or exceed 35 per cent.).

SPAULDING (P.). **White Pine blister rust: a comparison of European with North American conditions.**—*U.S. Dept. of Agric. Tech. Bull.* 87, 59 pp., 14 figs., 8 maps, 1929.

A comprehensive account is given of the author's observations, made during a tour of northern and western Europe (Germany largely excepted), on the prevalence of white pine blister rust (*Cronartium ribicola*) [cf. *R.A.M.*, vii, p. 814], detailed comparisons being made between European and North American conditions affecting the disease.

Pinus strobus trees of all ages from 4 to 118 years were seen, which were either dying or dead as a result of the disease. There were no indications whatever that old trees show more resistance than others. There is a direct relation between the vigour and susceptibility of the host; on the island of Oland, off Sweden, *P. strobus* trees growing poorly on an arid, limestone soil were found to be affected, but the disease was making little progress, whereas on the island of Bornholm, off Denmark, some 175 miles from Oland, where the conditions were more favourable to the trees, these were so severely attacked that they had become a total loss. A symptom of the disease upon large trees in Europe is the striking exudation of resin, which runs down below the canker and turns white.

Scarcely anywhere in Europe has the removal of all *Ribes* spp. been adequately tested. It would be necessary to make the safety zone much wider than in America, as damaging infections of *P. strobus* occur at decidedly greater distances from the source of infection than they do in North America. In Europe, wild *Ribes* are very rare except in certain limited areas, but the cultivated bushes are found in almost every garden throughout the entire region where the white pine can grow successfully. Nearly all the pine infections in Europe are due to *R. nigrum*, which is much more abundant than anywhere in North America. *P. strobus*, the favourite host of the fungus in Europe, is generally infected, but *P. cembra helvetica*, *P. peuce*, and *P. excelsa* are resistant.

There is a bibliography of over 200 titles.

YORK (H. H.). **White Pine blister rust in New York.**—*Papers Forest Protect. Conf., N.Y. Coll. of Forestry, 1926*, pp. 4–10, 1926. [Received June, 1929.]

In this paper [which was read at the Forest Protection Conference held in 1926 at the New York State College of Forestry] a brief historical outline is given of the introduction and discovery

in North America of the white pine blister rust (*Cronartium ribicola*) [see preceding abstract]. After pointing out the many mistakes which were made in the subsequent campaign against it, owing to lack of information on the causal organism and underestimation of its potentialities for harm, the author briefly summarizes the data obtained from an extensive series of investigations started in 1923 in the State of New York. An examination of every tree in 14 one-acre plots selected in natural stands of white pine on a line extending from Lake George to the Canadian border, showed that 50 per cent. of the trees are infected with the rust, and probably one-third will be killed within the next ten years. The great majority of the diseased trees belong to the more vigorous and thrifty class, and there is evidence that blister rust is killing the young reproduction of white pine almost as fast as it appears. The disease spreads by waves of infection, five of which are already known to have occurred between 1911 and 1924, each greater than the preceding one. There is a close relation between the spread of the rust and weather conditions, especially moisture and temperature, and it is believed that a new outbreak, in those places where the rust is apparently dormant for the present, will occur whenever a favourable set of weather conditions sets in. The crew method of controlling blister rust on a large scale [ibid., iii, p. 5; iv, p. 526] is both economically practical and efficient; in 1925, the total average cost of control work on private land in New York was 88 cents per acre, while the cost of initial protective work in the forests is estimated at only 35 cents per acre. Average forest conditions are known to be very unfavourable for the re-establishment of seedling currant and gooseberry bushes after eradication; most of those that are found in New York usually start between the clearing of the land and the complete establishment of the forest, and undoubtedly develop under relatively open conditions. All the evidence so far collected indicates that repeated eradication of currant and gooseberry bushes is rarely necessary, the only supervision needed being that of hedgerows, stone piles, and glades in the forests.

SCHMITZ (H.). **Decay in relation to the length of rotation.**—*Papers Forest Protect. Conf., N.Y. Coll. of Forestry, 1926*, pp. 14–30, 1926. [Received June, 1929.]

The author discusses at some length the part played by decay in forest trees, caused by wood-destroying organisms, in the determination of the length of rotation that should be adopted in North American forestry, and gives data, based largely on the work of Meinecke, Boyce, Weir, and others [most of which was published prior to the appearance of this *Review*] on this relationship in five of the more important species of forest trees in the United States.

A recompilation of the figures given by Boyce in his study of decay in Douglas fir [*Pseudotsuga taxifolia*: *R.A.M.*, iii, p. 115] showed that in this species the loss from decay is practically negligible until an age of approximately 160 years is reached, after which it rapidly increases, until after 250 years the periodic growth and cull increment are about equal. In other words, decay practi-

cally ceases to be a factor, if Douglas fir is grown on a rotation of 160 years or less.

In the case of incense cedar [*Libocedrus decurrens*] periodic growth is apparently high in the early life of the tree, but falls off steadily and fairly rapidly after 120 years, while cull increment is almost negligible until this age, after which it increases rapidly and exceeds the periodic growth at about 210 years. The rotation of this tree, therefore, if under 120 years, would be little influenced by decay.

Western hemlock [*Tsuga heterophylla*] grows fairly rapidly up to an age of about 120 years, after which its periodic growth drops off. In this species decay is negligible up to about 90 years, but then increases rapidly: at 100 years, about one-fourth of the periodic increment for a ten-year period is set off by decay. The latter will not be an important factor in rotations of less than 90 years.

In western white pine [*Pinus monticola*], the cull increment is small when compared with the periodic growth until an age of 160 years is reached, and even at 250 years it is only 50 per cent. of the periodic growth. The maximum yield is reported to be obtained with a rotation of 100 to 120 years.

In the aspen [*Populus tremuloides*] cull from decay in Utah is very small up to approximately 85 years of age, after which it increases very rapidly, until at about 110 years it exceeds the periodic growth of the tree, and at approximately 115 years is almost twice the latter. From a pathological point of view, rotation for aspen in the Lake states will probably be from 60 to 70 years, which is probably also a profitable rotation from the point of view of yield. It is believed, however, that the length of rotation for the aspen will vary in different parts of the United States, depending on the purpose for which the timber is to be used.

In the concluding pages of this paper it is pointed out that the above data are based on evidence collected in natural and unmanaged stands, and are not necessarily applicable to future stands handled under more or less intensive forest management. There is every reason to believe that well-managed forests will suffer materially less from decay than virgin stands. The data presented may also be somewhat exaggerated, as perhaps too much emphasis was put on individual trees instead of entire stands. Finally, the need is stressed of having more pathological data in order to render the research work to determine the profitable length of rotation really significant.

BOYCE (J. S.). **Deterioration of wind-thrown timber on the Olympic Peninsula, Wash.**—*U.S. Dept. of Agric. Tech. Bull.* 104, 28 pp., 1 fig., 11 graphs, 1929.

This is an expanded version of investigations carried out up to and including 1926 into the deterioration of timber thrown down by a terrific gale which swept over Olympic Peninsula, Washington State, in 1921, a preliminary account of which has already been noticed from another source [*R.A.M.*, vii, p. 69].

Altogether, the sporophores of 16 [named] species of wood-destroying fungi were found on the fallen timber. *Polystictus*

abietinus was present on the largest percentage of trees, followed by *Fomes pinicola*; the latter fungus caused the greatest total loss, being followed in this respect by *F. applanatus* [*Ganoderma applanatum*]. On the whole, there was little evidence of host selection by the various fungi, except that *P. cuneatus* was found only on western red cedar (*Thuja plicata*) and did the greatest damage to it (whereas all the other species, except *F. applanatus* and *P. versicolor*, which were present on a few trees, avoided this host), and that *G. oregonense* was found only on silver fir (*Abies amabilis*) and western hemlock (*Tsuga heterophylla*).

The total loss by the summer of 1926 (based on cubic-foot volume) was 22 per cent. in western red cedar, 34·2 per cent. in Douglas fir (*Pseudotsuga taxifolia*), 41·7 per cent. in Sitka spruce (*Picea sitchensis*), 55·8 per cent. in silver fir, and 68·4 per cent. in western hemlock; these figures include timber broken in falling and lost in stumps, but except in western red cedar and Douglas fir the greatest loss by far resulted from decay [loc. cit.].

SPAULDING (P.). **The role of fungi in the disposal of slash.**—*Papers Forest Protect. Conf., N.Y. Coll. of Forestry, 1926*, pp. 11–13, 1926. [Received June, 1929.]

In this note the author briefly discusses the relative value of fire, insects, and fungi in the destruction of slash left in the forests by tree-felling operations, with particular reference to the work done by wood-destroying fungi, such as *Lenzites sepiaria* and *Polystictus abietinus*. Some practical hints are given on the lines on which the study of this problem should be further conducted.

ELCOCK (H. A.). **The anatomy of the overgrowth on Sugar Beets caused by Bacterium beticola.**—*Papers Michigan Acad. Sci. Arts and Letters*, ix, pp. 111–115, 1 pl., 1929.

Two distinct types of overgrowths occur on sugar beets, viz., the rough, fissured, irregular galls, with decaying outer cells formed by *Bacterium beticola* ('tuberculosis') [*R.A.M.*, viii, p. 148] and the smooth, white, comparatively regular tumours produced by *Bact. tumefaciens*.

The examination of a cross section of the tuberculous type of overgrowth reveals small, yellowish, watery spots surrounded by greatly contorted tissue. The organism causing the neoplasm was found in a wide range of tissues, including the xylem, cambium, phloem, and cortex. The bacteria are restricted to small pockets surrounded by swollen tissues due to the development of new host cells or the enlargement of old ones. When there are meristematic cells in the vicinity, hyperplasia usually results, but when the bacterial cavities are surrounded by parenchyma cells, the overgrowths are usually due to hypertrophy. A study of cross sections of diseased material showed that in the early stages of infection the organisms are intercellular, collecting and multiplying at certain advantageous points in the cortex and between the cells of the cambium. The pressure and by-products produced by the bacterial activity at these points crush the immediately adjacent cells, thereby forming the disorganized cavities.

Under the stimulus of bacterial invasion the cambial cells divide

with abnormal rapidity, and consequently large amounts of hyperplasial tissue appear. This cell production takes place faster than the cells can differentiate into tissues, and the resulting excess of cells causes the cracking and splitting of the proliferated tissue.

The hypertrophied cells in the parenchyma of the cortex are of varying shape—cylindrical, polyhedral, and spherical with large intercellular spaces. There is no evidence of an epidermis in the later stages of gall development. As the proliferation develops, the epidermis is ruptured so that the large hypertrophic cells, with large intercellular spaces, are left exposed, thereby permitting the entrance of soil organisms.

The parenchyma cells adjoining the fibro-vascular bundles are thick walled and form the 'sugar sheath'. At this point the cells attacked by *Bact. beticola* lose their turgidity and undergo partial or total collapse, producing bacterial pockets. The organisms penetrate into the tracheal tubes and travel along them (possibly conveyed by the transpiration stream), only to reassemble in masses, break out, and form new pockets, some of which have been observed to extend over a length of two inches.

MEURS (A.). **Ein neuer Wurzelbranderreger der Zucker- und Futterrüben.** [A new causal organism of root rot in Sugar and Fodder Beets.]—*Phytopath. Zeitschr.*, i, 1, pp. 111–116, 2 figs., 1929.

A German diagnosis is given of *Pythium mamillatum*, isolated by the writer in the summer of 1927 from decayed beet on clay soil in Zeeland (Holland) [*R.A.M.*, viii, p. 188]. The fungus differs from the closely related species, *P. megalacanthum*, *P. artotrogus*, and *P. irregulare* in the presence of obtuse, frequently curved protuberances on the oogonia. It is further distinguished from *P. megalacanthum* by the smaller dimensions of the oogonia and from *P. artotrogus* by its mode of fructification and zoospore formation.

Klein-Wanzlebener-Vitrix and Collet Vert beets grown in soil inoculated with *P. mamillatum* developed root rot in a large proportion of the tests. The fungus was reisolated from the diseased material.

NUCKOLS (S. B.) & TOMPKINS (C. M.). **An undescribed leaf condition associated with damping-off diseases of Sugar Beet seedlings.**—*Phytopath.*, xix, 3, pp. 317–318, 2 figs., 1929.

Attention is drawn to a symptom, hitherto apparently overlooked, in connexion with damping-off of sugar beet seedlings [*Phoma betae*, *Pythium de Baryanum*, and *Rhizoctonia*: *R.A.M.*, vi, p. 709] in the western United States. Injured plants commonly develop bowed petioles, which cause the formation of a more open type of top than that characteristic of healthy seedlings. Plants with bowed petioles are readily recognizable by the time 8 to 10 leaves have developed, and very satisfactory results have been obtained by the instruction of thinners in this means of identification, which enables them to remove all infected plants during thinning.

WOODWARD (R. C.) & DILLON WESTON (W. A. R.). **Treatment of Sugar Beet seeds to prevent seedling diseases.**—*Gard. Chron.*, lxxxv, 2204, pp. 229–230, 1929.

During the past three years about ten preparations have been tested for the control of blackleg of sugar beet (*Phoma betae*, *Pythium de Baryanum*, and *Aphanomyces levis*) [*R.A.M.*, viii, p. 417] on seed from 26 English and Continental samples showing 44 to 89·5 per cent. infection. One of the proprietary organic mercury preparations [germisan] gave very promising results, increasing the stand by 50 per cent. in numerous tests and the dry and fresh weight, in one trial, by 6·9 and 11·4 per cent., respectively. This preparation is stated to be cheap, easily applied (at the rate of 5 oz. per gall. of water for 50 lb. of seed), and requires no special equipment. The results obtained with carbolic acid and with a dry organic arsenic powder were less satisfactory.

FOISTER (C. E.). **White tip disease of Leeks.**—*Gard. Chron.*, lxxxv, 2198, p. 106, 1 fig., 1929.

The so-called 'white tip' disease of leeks, first observed near Edinburgh in the autumn of 1928, is characterized by the following symptoms. The tips of the leaves die back and turn white for a distance of one to four inches. The affected areas generally become limp but may be stiff and crisp. Sometimes the margins are attacked and the leaves become twisted, while waterlogged areas subsequently develop towards the middle or base. Diseased plants rot away if mature, or remain stunted if attacked at an early stage. Similar symptoms are also reported from England. The disease was at first believed to be an unusual manifestation of downy mildew (*Peronospora schleideni*), but the fungus found in the infected areas was identified by S. F. Ashby as a species of *Phytophthora*. The fungus (cultural work with which is in progress) is characterized by oogonia measuring 27 to 39 μ, oospores 20 to 31 μ (average 27 μ), and sporangia 37 to 75 by 31 to 48 μ (average 58 by 42 μ).

MCCULLOCH (LUCIA). **A bacterial leaf spot of Horse-Radish caused by Bacterium campestre var. armoraciae, n. var.**—*Journ. Agric. Res.*, xxxviii, 5, pp. 269–287, 2 pl., 1929.

An account is given of a serious leaf spot disease of horse-radish [*Cochlearia armoracia*] which is known in Virginia, the District of Columbia, Connecticut, Iowa, and Missouri, in the United States, but apparently has not been described heretofore. Infected leaves bear numerous circular or angular spots, 1 to 4 mm. in diameter, translucent when young, and opaque, yellowish white to brown or even black, with a dark border surrounded by a definite translucent zone, or coalescent, when older. No bacterial exudation occurs from the lesions. The vascular system of the leaves is not affected; when a vein is occasionally included in a spot, it may darken, but the infection was never observed to spread in it beyond the border of the lesion. Heavily infected leaves die prematurely.

In the early stages of the disease intercellular spaces and apparently intact cells are filled with bacteria; later the cell walls break down, and the cavity thus formed contains a dense mass of bacteria. Inoculation experiments indicated that infection probably occurs through the stomata, and that those on the upper surface of the leaf are apparently considerably more susceptible to infection than those on the lower surface.

The causal organism (the pathogenicity of which to horse-radish was proved by successful inoculations) is a short, yellow, Gram-negative, not acid-fast rod, 0·7 to 2 by 0·3 to 0·5 μ, single or in pairs on beef agar, and provided with a single polar flagellum, three to six times the length of the rod; it does not form spores, but distinct capsules were observed. Its temperature relations are: minimum below 2°, optimum 28°, maximum 36°, and thermal death point near 51° C. In morphological and cultural characters (which are given at length in a comparative table) the organism is very similar to *Bacterium campestre* [*Pseudomonas campestris*] and *Bact. phaseoli*, but differs from them in host relations and reactions, which are discussed in detail. It was weakly parasitic on cabbage, cauliflower, and bean, while leaf spot infections on horse-radish were seldom obtained, even under favourable conditions, with *P. campestris* and *Bact. phaseoli.* The trinomial *Bact. campestre* var. *armoraciae* is suggested for the horse-radish organism.

VIDAL (J. L.). **La chlorose au pays de la craie.** [Chlorosis on chalk soils.]—*Prog. Agric. et Vitic.*, xci, 7, pp. 163–166, 1 fig., 1929.

Owing mainly to continuously unfavourable weather there was a severe and general recrudescence of vine chlorosis [*R.A.M.*, vii, pp. 297, 490] in France from 1925 to 1928, the disease being present in the latter year even on non-calcareous soils. Examples are cited of the diminution in the well-known resistance to chlorosis of 41B, which is particularly susceptible to the cold.

The following control measures used either singly or in combination gave excellent results: (*a*) Rassiguier's method [ibid., iv, p. 257], (*b*) winter applications to the soil of iron sulphate (3,000 kg. per hect.) followed at once by turning over the ground, a method the benefits of which are reported to last 4 or 5 years, (*c*) 2 to 5 applications to the leaves at intervals of 5 or 6 days, beginning as soon as they turn yellow, of iron sulphate solution (900 to 1,000 gm. per 100 l. of water), (*d*) so-called 'vaccination' in summer. This operation, which in 1928 was rapidly followed by excellent results, consists in making two or three close downward notches, or two or three sets of such triple notches, according to the severity of the disease, in the main stem or large branches, and filling them with a 5 to 20 per cent. iron sulphate solution. If concentrations of 15 to 20 per cent. are used, the leaves situated along the path of the sap containing the solution wither, and the corresponding part of the vine appears to be on the point of death; a day or two later, however, the leaves either regain normality, or if they should succumb this is soon more than compensated for by the good effects of the treatment on the new foliage.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

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FERRARIS (T.). **Zolfi grezzi nella lotta contro la crittogama della Vite.** [Natural sulphurs in the control of the Vine fungus.]—*Rivista Agricola*, xxv, 557, pp. 57–58, 1 fig., 1929.

After pointing out that wind-blown natural sulphurs, which have been used for over 50 years in the Campania, Italy, for the control of vine *Oidium* [*Uncinula necator*], cost less than half the price of the refined product, are finer, more adhesive, and neither produce scorching nor adversely affect the flavour of the wine, the author states that one of the best kinds is that known as 'Minerale di zolfo ventilato S.A.I.M.' [cf. *R.A.M.*, iii, p. 631; viii, p. 85], which is found at Altavilla Irpina. It is of a greenish colour and is sold in its natural state, after being pulverized and wind-blown. It contains rather more than 30 per cent. sulphur and is superior to any other form of the unrefined product by reason of the argillaceous gangue with which it is found mixed; this contains calcium carbonate and magnesium which increase its adhesiveness and fineness as compared with other sulphurs, the gangue of which usually consists of silica.

The author has for many years observed the excellent results in the control of *Oidium* given by this product. During two years spent in the vicinity of Avellino he noted that vines periodically treated with this sulphur remained quite free from infection and showed no scorching even after numerous applications in summer. In Piedmont, on the other hand, where much refined sulphur is still used, scorching is common. Muscat grapes are particularly susceptible to the injurious effects of refined sulphur. Further, in the author's own experience the calcareous gangue of this sulphur, by absorbing the moisture which may be present on the leaves and clusters, itself reduces the risk of infection.

Great economy would be effected by a wider use of this wind-blown sulphur.

[WORMALD (H.).] **Plant pathology. Mycology and bacteriology.**—*Ann. Rept. East Malling Res. Stat. 1st January, 1928, to 31st December, 1928*, pp. 97–106, 1929.

The following items, *inter alia*, are of interest in this report.

A strain of *Sclerotinia cinerea*, isolated from a plum twig, readily infected pear flowers and produced typical blossom wilt [*R.A.M.*, iii, p. 370].

As in previous years, the nature of the stock was observed to exert some influence on the degree of infection by apple scab [*Venturia inaequalis*] and mildew [*Podosphaera leucotricha*].

Severely cracked and russeted apples were found to be infected by a fungus apparently identical with *Coniothecium chomatosporum* [ibid., vii, pp. 222, 330]. Both sprayed and unsprayed fruit was affected, indicating that the damage was due to the parasite rather than to any fungicidal treatment.

Good control of raspberry anthracnose (*Plectodiscella veneta*) was again given by two applications of (*a*) lime-sulphur 1 in 10 and 1 in 40, respectively, and (*b*) Bordeaux mixture (12–12–100 and 6–6–100). Loganberries [*Rubus loganobaccus*] in the Kentish Weald have also been attacked by a fungus apparently identical with *P. veneta*, which proved amenable to control on the lines indicated above.

Two fungi have been isolated from diseased raspberry canes, one agreeing with *Cryptosporium minimum*, a parasite of rambler roses, and the other with *Microthyriella rubi*. Inoculation experiments with both these organisms gave positive results, but it is considered very doubtful whether either is capable of causing much damage.

Further evidence has been afforded by inoculation experiments of the parasitic nature on hops of *Verticillium albo-atrum*, which is now finally demonstrated to be the causal organism of hop wilt [ibid., vii, p. 616].

A species of *Verticillium* was isolated from diseased rhubarb crowns near Sandwich and inoculated into seedlings with positive results.

PETRI (L.). **Rassegna dei casi fitopatologici osservati nel 1928.** [Review of phytopathological records in 1928.]—*Boll. R. Staz. Pat. Veg.*, N.S., ix, 1, pp. 1–65, 1929.

Owing to unfavourable weather, plant diseases were unusually prevalent in Italy during 1928. Only a few of the many interesting records can be noticed here. In many widely separated districts vines were attacked by *Aureobasidium vitis* [*R.A.M.*, vi, p. 532], associated with mechanical injuries caused by storms; black rot of the grapes (*Sterigmatocystis nigra*) [*Aspergillus niger*] was reported from Sassari and the vicinity of Rome. In southern Italy leaf roll of the vine was present only on alkaline soils, but in certain northern localities it was found on slightly acid ones [cf. ibid., vii, p. 763]; a clay soil favours the disease, and may perhaps be essential to it. Affected shoots of the Rupestris du Lot variety from the province of Trentino showed few intracellular cordons [ibid., vii, p. 556] in the internodal epidermis, though many in the wood and phloem; in affected vines in Sicily, on the other hand, these bodies are very numerous, and it is considered that their formation depends on local external conditions. The misshapen leaves and stunted internodes further indicate this. The condition was found to have been present in a latent form on one

vine since it was 7 years old, only becoming apparent in the inclement spring of the year under review. Rachitis of vine branches [ibid., i, p. 50] was reported from the vicinity of Trent, where the condition is not uncommon, especially on Nosiola and Portuguese vines, and occasionally on Muscats.

Frost lesions of olive trees preceded attacks of *Bacterium* [*Pseudomonas*] *savastanoi* throughout the Mediterranean basin.

Further evidence was obtained that 'mal secco' disease of lemons in Sicily [ibid., viii, p. 35] is due primarily to faulty soil rather than to *Colletotrichum gloeosporioides*. A decree issued 5th October, 1928, makes it obligatory for growers to cut away and burn affected branches on trees within a specified area in the province of Messina.

White rust of lemons at Parma was associated with a species, probably saprophytic, of *Phoma*. *Rhynchodiplodia citri*, to which Briosi and Farneti attributed the disease, was not found and the condition is ascribed to infestation by the mites *Phyllocoptes oleivorus* or *Heliothrips haemorrhoidalis*. Lemons were found after picking to have been attacked by numerous [named] fungi, while some showed deeply sunken brown spots, attributed to *Phytomonas* [*Pseudomonas*] *citriputeale* [ibid., viii, pp. 235, 236].

A species of *Fusarium* was found in the rotted roots and collar of young pines (*Pinus pinea*) near Rome; the smooth-walled, terminal uni- or bilocular chlamydospores measured 10 to 12 μ in diameter, and in many cases the basal cell was sterile. The triseptate, slightly curved conidia were rounded at the extremity. Unfavourable soil predisposed the trees to attack.

Chestnuts in the vicinity of Castrovillari showed a withering of the branches and shoots caused by *Coryneum perniciosum* [*Melanconis modonia*: ibid., vi, p. 6].

Extensive notes are given on the prevalence and distribution of foot rot of wheat (*Leptosphaeria herpotrichoides*) in Italy.

VAN POETEREN (N.). **Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1927.** [Report on the activities of the Phytopathological Service in the year 1927.]—*Versl. en Meded. Plantenziektenkundigen Dienst te Wageningen*, 55, 93 pp., 6 pl., 1 diag., 1929.

Among the many interesting items in this report, prepared on similar lines to those of previous years [*R.A.M.*, vii, p. 425], the following may be mentioned. Potato blight (*Phytophthora infestans*) occurred in a very severe form in 1927, often causing losses of 15 to 20 per cent. of the crop [ibid., vii, p. 664].

Beets in Zeeuwsch-Vlaanderen were mildly attacked by *Cercospora beticola* [ibid., viii, pp. 8, 9]. Root rot (*Phoma betae*) was again well controlled by disinfection of the seed-clusters with liquid fungicides or dusts, as well as by means of warm water [ibid., vi, p. 648].

The so-called 'red' disease of flax, which caused heavy damage in the Zierikzee district of Zeeland, was found to be associated with *Phoma herbarum* [ibid., i, p. 175], *Polyspora lini* [ibid., v, pp. 208, 421], *Colletotrichum linicolum* [*C. lini*: ibid., vi, p. 462; vii, p. 580], and other organisms of minor importance. Since the

disease was first observed in an advanced stage, the investigations could not be completed in 1927, and no fresh signs of infection had appeared at the time of writing in 1928.

Blue maw bird-seed plants [*Papaver somniferum*] were attacked by the fungus *Dendryphium penicillatum*, producing black spots on the stalks and midribs of the leaves.

Cox's Pomona apples at Winterswijk were found to be infected by *Phyllosticta solitaria*, the occurrence of which in Holland was suspected but hitherto not confirmed.

Cherry trees are frequently affected by a dying-off of the buds, accompanied by the production of small leaves and fruits; in many cases the lateral roots also die in consequence of an excessively high water level. A species of *Fusarium* was isolated from some of the diseased buds, but although *F. gemmiperda* [? *F. fructigenum*: ibid., vi, p. 734] has been described as the cause of dying-off of stone-fruit buds, the disturbance in question is attributed primarily to physiological causes.

Beans [*Phaseolus vulgaris*] in various parts of Zeeland showed a swelling and discoloration of the stalks and petioles, at the base of which reddish-brown, sunken spots developed; the leaves, when not already shed, were dry and shrivelled, with elongated brown spots between the veins. A species of *Fusarium* and various bacteria were isolated from affected plants, and it is thought that these organisms may be responsible for the above-mentioned symptoms.

Freesia bulbs were infected by *Sclerotium gladioli*, the causal organism of dry rot of gladiolus corms [ibid., vii, p. 724]; the latter were attacked in the same nursery and the infection is believed to have come from the soil. Good control was obtained by disinfecting the soil with a 0·25 per cent. solution of uspulun, which increased the yield in certain cases by 10 to 35 per cent. Hydrangea mildew (*Sphaerotheca castagnei* or *Erysiphe polygoni*) [ibid., vii, p. 447] was very prevalent and severe, especially on the Madame Mouillière variety. Sulphur fumigation by means of the improved Rota Generator [ibid., iv, p. 357] gave good control of this disease.

American oaks [*Quercus* spp.] planted along a roadway suffered from a root rot associated with excessive soil moisture; the fungus *Myxosporium pallidum* Faut. was found on a number of dead branches, but is believed to be of secondary importance.

The section on experiments and investigations (pp. 47–75) contains reports on a number of tests for the control of various important diseases.

[MITRA (S. K.).] **Mycology.**—*Ann. Rept. Dept. of Agric., Assam, for the year 1927–28*, pp. 36–37, 1928. [Received June, 1929.]

A disease of betel vines [*Piper betle*], characterized by brownish, later yellowish and ultimately black spots on the stems and leaves and by brittleness of the nodes, has caused considerable damage during the period under review. Bacteria and the mycelium of an unidentified fungus were found on the affected material.

Pink disease (*Corticium*) [*salmonicolor*] was found causing serious damage to the orange crop near Theria.

Heavy infection by mildew (*Phyllactinia corylea*) was observed on the mulberry trees at the Sericultural Farm, Titabar [ibid., viii, pp. 18, 88].

The Co. 17, P.O.J. 2714, Co. 210, Co. 213, and J. 247 varieties of sugar-cane were severely attacked by red rot and collar rot (*Colletotrichum falcatum* and *Hendersonina sacchari*, respectively).

Thirty-eighth Annual Report of the Alabama Agricultural Experiment Station for the fiscal year ending June 30, 1927. —32 pp., 3 figs., [? 1927. Received July, 1929].

This report contains the following references of phytopathological interest. Black rot of sweet potatoes [*Ceratostomella fimbriata*] was found in greenhouse tests to be most severe on the Gold Coin, Southern Queen, Nancy Hall, and Porto Rico varieties, while Dooley, Bunch Yam, and Yellow Yam are moderately susceptible, Big Stem Jersey and Triumph less so, and Bigwig White No. 23 relatively resistant.

Good control of the pecan [*Carya pecan*] scab fungus [*Cladosporium effusum*: *R.A.M.*, viii, p. 114] was given by three or four applications of 3–3–50 Bordeaux mixture, beginning about 15th May. In 1926 scab was so severe on Delmas pecans that no nuts were matured; the Pabst and Schley varieties were also infected, while Centennial, Frotscher, Columbian, Russell, Stuart, Van Deman, and an unknown variety (probably Brooks) remained healthy.

Fortieth Annual Report of the Arkansas Agricultural Experiment Station for the fiscal year ending June 30, 1928.— *Arkansas Agric. Exper. Stat. Bull.* 231, 82 pp., 14 figs., 2 graphs, 1928. [Received July, 1929.]

A few scattered references of phytopathological interest, in addition to those already noticed from other sources, occur in this report. Pressure-treated pine posts showed no decay after five years' service, whereas 62 per cent. of the butt-treated, unseasoned oak posts were unfit for use at the end of four years. Cured native oak posts given a 24-hour butt-treatment in hot and cold bath creosote failed to the extent of 3·1 per cent. after five years, 16·8 per cent. after six, and 28·05 per cent. after seven. At the end of two years small treated post specimens showed slight fungus growth and termite action, while the untreated controls exhibited 7·7 per cent. complete failure and 33 per cent. partial decay or termite injury.

The causal organism of stem rot of rice (*Sclerotium oryzae*) [*R.A.M.*, viii, p. 263] has been found to retain its viability for at least 18 months in dry soil under greenhouse conditions.

Report of the California Agricultural Experiment Station from July 1, 1927, to June 30, 1928.—127 pp., 1929.

In addition to information already noticed from other sources, this report contains the following items of phytopathological

interest. Many of the commercial strawberry varieties are almost immune from yellows [*R.A.M.*, vii, p. 650], but it will be necessary to replace the extremely susceptible Banner (almost exclusively cultivated in the San Francisco Bay region) by a more resistant strain.

Promising results in the control of walnut blight [*Bacterium juglandis*: ibid., vii, p. 176] were given by the application of Bordeaux mixture and other copper sprays, beginning after the inception of new growth in the spring.

In advanced stages of crown rot of walnut [ibid., vii, p. 16], a *Phytophthora* (probably *P. cactorum*) is readily isolated from active margins of the bark cankers. Inoculation experiments with this fungus on English walnuts [*Juglans regia*] resulted in the development of typical crown rot lesions.

Further work on sour sap and gummosis of fruit trees [ibid., vii, p. 621] substantiated previous conclusions as to the bacterial origin of these disturbances. Infection occurs mainly through pruning wounds and trunk lesions on young plum, prune, apricot, and cherry trees.

Two serious and possibly infectious diseases of cherries, known as 'buckskin' and 'crinkle', the etiology of which is obscure, received considerable attention. At present these troubles are confined to a limited area, and eradication appears to be the sole feasible control measure.

A considerable improvement in the condition of peach, apricot, and plum trees suffering from little leaf or yellows [ibid., viii, p. 111] has been effected by fairly large applications to the soil of iron sulphate (20 to 70 lb. per tree).

A high degree of resistance to gummosis (*Pythiacystis*) [*Phytophthora citrophthora*: ibid., viii, p. 378] has been shown by sour oranges [*Citrus bigaradia*: ibid., vii, p. 16], the Sampson tangelo, some of the citranges, the Trimble tangerine, and the Lester mandarin. New hosts of this fungus are watermelons, squashes, and pumpkins.

Field experiments on the control of powdery mildew of cantaloupes [*Erysiphe cichoracearum*] in the autumn of 1927 showed that the development of infection is favoured by shading the plants with muslin covers [ibid., viii, pp. 23, 219]. The addition of potassium permanganate as an oxidizing agent to the sublimed sulphur dust increased damage to the foliage of the plants. Good control of the disease was obtained by three applications of Bordeaux mixture (early in April, four weeks later, and eight weeks later), but fertilizer treatments gave negative results. Owing to the prevalence of mosaic (75 to 90 per cent.) it was difficult to estimate the importance of the sulphur injury.

A species of *Diplodia* has been isolated from the diseased petioles of date palms [*Phoenix dactylifera*] and shown by inoculations to be capable of producing definite lesions and death of normal tissue.

Fusarium ear rot of maize [(?) *Gibberella moniliformis*: ibid., viii, p. 292], the most common and destructive disease of this crop in California, has been well controlled on peat soil experimental plots near Middle River by seed treatment with Bayer dust (4 per

cent. hydroxymercurinitrophenolsulphate and 96 per cent. inert matter), and improved semesan jr. (12 per cent. hydroxymercuri-cresol and 88 per cent. inert matter).

Studies on the inheritance of resistance to wheat bunt (*Tilletia tritici*) [*T. caries*] in a cross between White Odessa and White Federation indicate that the former possesses a single dominant factor for this character. From a cross of Hussar, a completely resistant variety, with the susceptible Hard Federation, some strains have been isolated breeding true for a small percentage of bunt (1 to 10 per cent.). This phenomenon has been observed in all crosses of completely resistant with susceptible varieties.

Preliminary data on 25 collections of covered smut of barley (*Ustilago hordei*) from different parts of California indicate the existence of at least three distinct biological forms of this fungus [ibid., vii, p. 560].

Agricultural experiments, 1927.—*New Hampshire Agric. Exper. Stat. Bull.* 232, 35 pp., 8 figs., 1928. [Received July, 1929.]

The following items of phytopathological interest occur in this report. Recent studies by O. Butler have shown that Bordeaux mixture is injurious to plants where the proportion of lime in the preparation is low. When four times as much lime as copper was used, no damage occurred on apples, but in the case of the peach it was necessary to make the proportion six to one. No injury from spraying was observed where the foliage of the trees was protected from dew and rain. In the absence of this precaution, however, the damage decreases with the increase of lime in the mixture [cf. *R.A.M.*, viii, p. 482].

A correlation has been observed between low productivity and the incidence of bitter pit of apples [ibid., viii, pp. 251, 252]. In 1924, when the crop was heavy, only 2·38 per cent. of bitter pit was recorded, whereas in 1925, a poor apple season, the incidence of this disease amounted to 18·87 per cent.; in the productive year of 1926, the percentage again fell to 1·40.

In a comparative test on the development of leaf roll in Maine potatoes grown (*a*) at East Kingston, New Hampshire, and (*b*) at the original locality of production, it was found that 39 per cent. of the former stock was infected in 1926 (after four years) compared with 12 per cent. of the latter. An attempt to obtain immature seed of satisfactory quality by planting late in June and harvesting towards the end of September (1925) resulted in 0·78 per cent. mosaic and 1·17 per cent. leaf roll. In 1926 the stock from the late planted seed showed 42·9 per cent. net necrosis [ibid., viii, p. 331] compared with only 3·2 to 4·6 per cent. in early planted (May) seed. The removal of tubers showing net necrosis before planting failed to give complete control of this disease. It was found that a very high proportion of leaf roll tubers may be recognized by their manner of sprouting.

New Hampshire Agricultural Experiment Station Report for 1928.—*New Hampshire Agric. Exper. Stat. Bull.* 238, 35 pp., 8 figs., 1929.

This report contains the following items of phytopathological

interest. It is estimated that in 1927 the time spent on spraying or dusting potatoes against late blight [*Phytophthora infestans*] in New Hampshire was 5·4 hours per acre. Commercial dusts cost about 20 per cent. more for the same area than the sprays. The former are more effective on moist plants and the latter on dry ones.

Owing to deterioration from leaf roll, all attempts to produce satisfactory seed potatoes in southern New Hampshire have failed [see preceding abstract]. Seed planted at Northwood in 1926 produced 4·48 per cent. leaf roll plants; in 1928 there were 39·3 per cent. weak-sprouted tubers and the stock was worthless. At Colebrook, where the mean temperature is lower than at Northwood and East Kingston, there has been no material deterioration of potato seed stocks during the last seven years. At East Kingston the mean number of hours per diem when the temperature was over 25° C. for 5 years was 2·51, compared with 1·6 at Colebrook, where mosaic is the prevalent disease. Mosaic plants exposed to a temperature above 25° for one hour daily still show symptoms of the disease, which become obscure and eventually disappear after protracted exposures. The mean number of hours per diem when the temperature is below 10° is 4·3 at Colebrook and 3·1 at East Kingston. Leaf roll shows no tendency to increase at the former station, but it has spread rapidly during the two years at East Kingston when the number of cool hours per diem was only half that at Colebrook.

Good control of bean [*Phaseolus vulgaris*] anthracnose [*Colletotrichum lindemuthianum*] was obtained by preheating the seed of the Red Kidney and Bountiful varieties at 80°, 85°, and 90° C. for 4 to 10 hours.

Using a Burgundy mixture in which the ratio of copper sulphate to sodium carbonate was 1 : 1.84, O. Butler found that the method of mixing and the temperature affect the rate of settlement of the precipitate to a slighter extent than in Bordeaux mixture. Mixtures in which the ratio is 1 : 1·5 or above were found to decompose with the formation of malachite, while those with the ratio of 1 : 1 produced a blue copper carbonate.

What's new in farm science.—*Ann. Rept. Wisconsin Agric. Exper. Stat. 1927–1928* (*Bull.* 405), 128 pp., 45 figs., 4 diags., 1929.

In addition to items already noticed from other sources, this report contains the following references of phytopathological interest. Bean mosaic [*R.A.M.*, vii, p. 495; viii, p. 294] was responsible for heavy losses (up to 50 per cent. of the crop in the highly susceptible Refugee varieties).

Resistance to cabbage yellows [*Fusarium conglutinans*: ibid., viii, p. 294] has been demonstrated to be dominant to susceptibility, inheritance being governed by a single Mendelian factor. When plants from selected resistant lines were crossed with susceptible ones, the F_1 hybrids were as resistant as the resistant parents. The F_2 progeny of these hybrids, crossed among themselves, showed approximately a quarter of the individuals susceptible and the rest resistant. Of 5,493 F_2 plants grown for

three years on infested soil, 1,408 or 25·6 per cent. became diseased.

Corticium vagum [*C. solani*] is stated to be a more important cause of damping-off of sugar beets under Wisconsin conditions than *Phoma betae* [ibid., vii, p. 419]. Seed treatment with chlorophenolates of mercury gave good control in 1927, while in 1928 a new mercury ethyl compound was found even more effective.

Corrosive sublimate gave consistently better results in the control of potato *Rhizoctonia* [*C. solani*] and scab [*Actinomyces scabies*] than semesan bel or Bayer dip dust [ibid., viii, p. 401].

Good control of aster yellows [ibid., vii, p. 446] and wilt [*F. conglutinans* var. *callistephi*] has been secured by the cultivation of wilt-resistant strains, Late Giant Branching and Heart of France, under tobacco cloth to exclude the insect vector [*Cicadula sexnotata*] of the yellows disease.

Brown rot of cherry [*Sclerotinia americana*: ibid., viii, p. 386] occurred in an unusually severe form in Door County, causing up to 15 per cent. infection of the blossoms.

Two pure lines of spring wheat selected for resistance to *Gibberella saubinetii* were grown at various localities in Canada, Wisconsin, South Dakota, and Illinois; the resulting crop proved highly susceptible in the last-named State, while elsewhere resistance was shown. It was ascertained by greenhouse tests that growth at temperatures above 68° to 75° F. predisposed the seedlings to infection [ibid., vii, p. 777]. On the other hand, maize grown in Illinois proved highly resistant to *G. saubinetii* and *Penicillium oxalicum* [ibid., viii, p. 377], which caused severe damage in the Wisconsin-grown crop. Marked differences were observed in the composition of the embryo of the wheat and maize grown in the different localities. Attention is drawn to the toxic effects on animals of grain containing 20 to 30 per cent. scabbed kernels [ibid., viii, pp. 439, 440].

A wheat variety, Progress, resistant to rust [*Puccinia graminis*] is stated to be giving very satisfactory yields.

KUYPER (J.). **Verslag van het Deli Proefstation over het jaar 1928.** [Report of the Deli Experiment Station for the year 1928.]—*Meded. Deli Proefstat. te Medan-Sumatra*, Ser. II, lx, 59 pp., 1929.

The following references of phytopathological interest occur in this report. Promising results in the control of slime disease of tobacco [*Bacterium solanacearum*] were again given by steam sterilization of the seed-beds at a temperature of 80° to 100° C. for 45 to 60 minutes [*R.A.M.*, vii, p. 679]. In a test comprising 32 beds the incidence of infection was reduced from 44·9 to 29·1 per cent. Some plants that survived in a heavily infected plot proved rather more resistant to *Bact. solanacearum* than line 1 of the Deli Experiment Station. The three ornamental species, *Nicotiana sanderae*, *N. silvestris*, and *N. affinis*, were found to be extremely susceptible to slime disease.

Mosaic was disseminated by smearing the hands of the coolies with infective material before they searched the plantations for

caterpillars; by setting seedlings in soil infected by diseased tobacco refuse; and by needle prick inoculations. The aphid *Myzus persicae*, known elsewhere as a carrier of the disease, occurred in large numbers on the control plants which remained healthy, suggesting that its rôle in the spread of mosaic is a minor one under Deli conditions.

Top rot, one of the most important tobacco diseases of unknown origin [ibid., vii, p. 309], has been found to be closely connected with the composition of the soil, occurring exclusively on the so-called subhydric, weathered types, and chiefly affecting plantations situated along the roadside. Pot experiments have given indications that the application of lime to the soil favours the development of top rot, while copper sulphate reduces the incidence of the disease. The cause of the so-called 'korab' disease, characterized by the presence of various kinds of necrotic spots and stripes on the leaves, is also obscure.

Red rust [ibid., vii, p. 680] has been observed to occur mainly on the Deli varieties with very broad leaf bases, e.g. D.P.S. 84. The F_1 generation of a cross between this strain and an ordinary Deli type appears to be intermediate in character between the two parents, having a moderately broad leaf base and showing few spots on the leaves. In a series of tests to determine the influence of fertilizers on the incidence of red rust, no benefit was derived from extra applications of phosphate in various forms.

Barn rot, characterized by severe infection of the stalks, which rapidly spreads along the veins over the entire leaf, was very prevalent during 1928. The disease is attributed to the action of a bacterium which thrives in a very humid and ill-ventilated atmosphere, and control measures should be based on an improvement in the existing conditions of the curing barns.

Sago palms [(?) *Arenga saccharifera*] were affected by a die-back due to undetermined causes.

The cultivation of *Hibiscus sabdariffa*, which has been suffering from an unidentified fungous disease, has been discontinued at Deli.

PATEL (M. K.). **Viability of certain plant pathogenes in soils.**—*Phytopath.*, xix, 3, pp. 295–300, 1929.

Virulent cultures of *Pseudomonas* [*Bacterium*] *tumefaciens* were isolated from sterilized, and then inoculated, clay, loam, and sand kept in the laboratory for 736 days after inoculation. Infection was produced on tomatoes with colonies of *Bact. tumefaciens* obtained from unsealed and sealed unsterilized loam and sand cultures 587 and 669 days, respectively, after inoculation, and in clay after 539 days.

Bact. tumefaciens, *Bact. marginatum*, *Bact. phaseoli*, *Bacillus carotovorus*, and *B. atrosepticus* overwintered successfully in sterilized and unsterilized loam soil in the open at Ames, Iowa (minimum temperature -32° and maximum 20·5° C.) [*R.A.M.*, vii, p. 564]. *Bact. tabacum*, *Pseudomonas citriputeale*, and *Bact. beticola* [ibid., viii, p. 541] were also recovered from overwintered, sterilized loam soil cultures.

MAGROU (J.). **Sur l'action à distance du Bacterium tumefaciens.** [On the action at a distance of *Bacterium tumefaciens*.]—*Rev. Path. Vég. et Ent. Agric.*, xvi, 2, pp. 69–70, 1929.

The author states that he has repeated in different seasons and localities the experiment previously reported [*R.A.M.*, vii, p. 365], in which the eggs of the sea-urchin (*Paracentrotus lividus*) immediately after fertilization were exposed through a quartz screen to a suspension of *Bact. tumefaciens* in nutrient broth. A large proportion of the eggs so exposed gave rise to markedly abnormal larvae, whereas the control eggs which were either unexposed or exposed through a glass screen developed normally.

Histological examination showed that the morphological differences noted were associated with a structural difference; in the control larvae the mesenchymatous cells were thinly scattered, whereas in the larvae exposed through quartz they were much more numerous, often filling the general cavity.

These facts are considered to confirm the results previously obtained [loc. cit.] as to the action exercised at a distance by *Bact. tumefaciens*; the stimulus does not appear to be a chemical one, and it acts through quartz but not through glass.

GASSNER (G.) & STRAIB (W.). **Untersuchungen über die Abhängigkeit des Infektionsverhaltens der Getreiderostpilze vom Kohlensäuregehalt der Luft.** [Investigations on the dependence of the infection relations of the cereal rust fungi on the carbonic acid content of the atmosphere.]—*Phytopath. Zeitschr.* (formerly *Forsch. auf dem Gebiet der Pflanzenkrankh. und der Immunität im Pflanzenreich*), i, 1, pp. 1–30, 1 col. pl., 1 diag., 1929.

Pursuing their investigations on the infection conditions of the rust fungi [*R.A.M.*, viii, p. 361], the authors conducted a series of experiments [the technique of which is described] to determine the relation between the carbon dioxide content of the atmosphere and the development of infection by *Puccinia glumarum* on Heine's smooth Teverson winter wheat, *P. triticina* form xiv [ibid., viii, p. 366] on Strube's Dickkopf winter wheat, *P. dispersa* [*P. secalina*] on Petkus winter rye, *P. graminis* f. sp. *tritici* on Strube's Dickkopf wheat, and *P. coronifera* [*P. lolii*] on Beseler iii yellow oats.

It was found that no infection took place in the absence of carbon dioxide, while a deficiency led to a prolongation of the incubation period and reduced the incidence of infection. The normal CO_2 content of the atmosphere suffices to ensure the infection of plants standing on open shelves in the greenhouse, but an increase in concentration augments the number of rust pustules and curtails the incubation period; it further facilitates the infection of resistant varieties. However, when the CO_2 content is raised above a certain limit, infection is prevented or reduced to a minimum; in some cases spotting of the leaves may be substituted for pustules. The optimum CO_2 concentrations (as measured at the beginning of each experiment) for infection by the rusts on the cereals used in these tests were found to be as follows: *P. glu-*

marum and *P. graminis* f. sp. *tritici* 0·3 to 0·75 per cent.; *P. triticina* 0·15 to 0·3; *P. secalina* 0·15 to 0·75; and *P. lolii* 0·15 to 0·5. The following were the maximum concentrations of CO_2 tolerated by these organisms: *P. glumarum* 3 per cent.; *P. triticina* and *P. graminis* f. sp. *tritici* 6; *P. secalina* 4·5; and *P. lolii* 4·5.

Although the type of infection is somewhat modified by growing the cereal plants at varying CO_2 concentrations, the relative differences between resistant and susceptible varieties and between the specialized forms of *P. triticina* are maintained.

Experiments are described and discussed which indicated that the increased incidence of infection resultant on a moderate rise in the CO_2 content of the atmosphere may be attributed to the improved assimilation and carbon nutrition of the plants and to the influence of these conditions on the nutrition of the rusts. When, however, the CO_2 content of the atmosphere is raised beyond a certain point, the assimilatory activity of the green cells of the plants is abnormally affected, and the resulting metabolic products act adversely both on the development of the rusts and on the growth of the cereals. This action on the fungus is indirect, as experiments showed that concentrations of CO_2 within the limits tested had no injurious effect on the germination or germ-tube development of the rusts, nor on the maturation of pustules that had begun their development at normal concentrations.

SCHEIBE (A.). **Zur Frage der Diagnostik und der Untersuchung auf Reinheit von Getreidesorten mit Hilfe von Rostbiotypen.** [On the question of the diagnosis and examination of cereal varieties for purity with the aid of rust biotypes.]—*Pflanzenbau*, v, 17–18, pp. 263–267, 1929.

The writer's extensive researches on the physiological forms of brown rust of wheat (*Puccinia triticina*) [*R.A.M.*, viii, p. 365] lead him to somewhat different conclusions from those reached by Rudorf [ibid., vii, p. 771] in respect of the value of the biotypes in distinguishing varieties of the host plant. Practically speaking, the exact identification of the different varieties on the basis of their reaction to the physiological forms of *P. triticina* is hardly feasible, since the great majority of the German varieties do not show sufficiently distinctive reactions to the strains of the fungus available. On the other hand, this character may possess a limited value in the determination of varietal purity in the early stages of development of the host in the relatively few cases in which the different components of the mixture show different reactions to the several rust strains.

LIMBOURN (E. J.). **Varietal bunt resistance tests—1928.**—*Journ. Dept. Agric. Western Australia*, 2nd Ser., vi, 1, pp. 199–205, 1929.

Since the inception in 1921 of annual trials of wheat varieties for resistance to bunt [*Tilletia caries* and *T. foetens*], at the Merredin Experiment Farm, Western Australia, 153 named varieties [a list of which is given] have been tested, among which only one—Genoa (P. 1511)—has proved to be fully immune from the disease.

Three other varieties, namely, Dindiloa (P. 1437), Florence (P. 223), and S.H.J. (P. 1445) were highly resistant, showing slight infection only under adverse conditions. Carrabin (P. 1437), which showed high resistance under normal conditions, proved to be slightly susceptible under certain other conditions, infection being mostly confined to the secondary or late growth; it is therefore believed that a resistant strain of this variety may be obtained by selection.

For the purpose of the tests in 1928, a wheat plant was considered to be infected even if it showed the presence on it of only a single ball of bunt. It was noticed, however, that both with bunt and with flag smut [*Urocystis tritici*: *R.A.M.*, viii, p. 369] the degree of infection per plant is directly proportional to the percentage of infection in the variety. It was also found that a variety, which under normal conditions is highly resistant to bunt, becomes infected to a greater extent when its growth is checked by some other cause. The tests also indicated that, in very susceptible varieties, the effect of infection with bunt was to stimulate the growth of the plants, uninfected plants in the same plots being comparatively weakly.

SOUTHERN (B. L.) & LIMBOURN (E. J.). **Copper powders for the prevention of bunt in Wheat.**—*Journ. Dept. Agric. Western Australia*, 2nd Ser., vi, 1, pp. 162–165, 1929.

Brief details are given of further experiments which were made in 1927 and 1928 at the Chapman and Merredin Experiment Farms, in continuation of previous work [*R.A.M.*, vi, p. 543], to test the efficacy of various copper dusts in the control of wheat bunt [*Tilletia caries* and *T. foetens*], and also with a view to determining the reasons why some powders show marked superiority over others. The trials included most of the preparations formerly tested, with the addition of 'B' (a commercially pure basic copper carbonate), 'D' (a mixture of about one part of copper carbonate to three of a complex basic sulphate), and 'smutol' (an oxychloride of copper). The rate of infection of the seed was 20 parts of spores to 750 parts by weight of wheat in 1927, and 10 parts spores to 750 parts wheat in 1928. The results [which are presented in tabular form] showed that, under the conditions of the experiments, pure basic copper sulphate had better fungicidal properties than the basic carbonates, and that the addition of basic carbonate to the basic sulphate reduced the efficacy of the latter in the loam and increased it in sandy soil. It was thus demonstrated that the efficacy of a given copper dust is in direct relationship to the nature of the soil on which the dusted wheat is grown. The variations in the final results obtained by the same treatment in different portions of one and the same plot may be in part accounted for by the fact that the analysis of the water-soluble extracts taken daily from different parts of the experimental plots showed marked variations. The partial chemical and physical composition of the dusts tested is also given in a table.

There was again evidence of the controlling effect of the copper dusts on seedling rot (*Pleosphaeria semeniperda*), since the disease was only found in the control rows. as in previous years. It only appeared after a crust, due to heavy rain, had formed on the soil.

HENRY (A. W.) & FOSTER (W. R.). **Treatment of seed grain.**—*Alberta Univ., Dept. of Field Crops, Circ.* 5, 13 pp., 1 diag., 1929.

This is a general account of the various methods of seed treatment used for the control of fungous diseases in Alberta (Canada). Wheat and other hull-less grains should be treated with copper carbonate at the rate of 2 oz. per bushel, applied by rotating the dust and grain in a closed mixer. Formalin (1 in 320) is preferable, however, for the disinfection of ordinary oats and barley, and in some cases for wheat containing numerous unbroken bunt [*Tilletia caries* and *T. foetens*] balls [*R.A.M.*, viii, p. 368].

HEUBNER (W.). **Über das Verhalten von Pflanzen nach Quecksilberbeizung der Samen.** [On the reaction of plants to mercury disinfection of the seeds.]—*Zeitschr. Physik. Chemie*, Ab. A, cxxxix, pp. 198–210, 1 fig., 1928.

The writer describes and tabulates the results of his experiments in the disinfection of wheat seed-grain [against unspecified fungous diseases] with germisan and uspulun, each applied in solutions of 0·5 and 0·25 per cent. No stimulus to germination was observed to result from the treatment. Mercury was found in the sprouts, roots, and cotyledons of the treated plants to the extent of 0·66, 0·74 and 0·75 mg. per 100 gm., indicating the absorption of the mineral into the living tissues in appreciable amounts [*R.A.M.*, vii, p. 796].

NIETHAMMER (ANNELIESE). **Versuche zur Deutung der stimulierenden Wirkung von Uspulun Universal beim Auflaufen des Saatgutes. I. Mitteilung. Die Desinfektionskraft.** [Attempts at the interpretation of the stimulatory action of uspulun-universal on the emergence of the seed. Note I. The disinfection capacity.]—*Zeitschr. für Pflanzenkrankh. (Pflanzenpath.) und Pflanzenschutz*, xxxix, 3, pp. 120–122, 1929.

In a series of experiments [the technique of which is briefly described] to determine the fungicidal effect of uspulun-universal [*R.A.M.*, v, p. 619], the following organisms adhering to the seed-grain of Postelberger Wechsel wheat were destroyed by two hours' immersion in a 0·25 per cent. solution of this preparation: *Aspergillus niger*, *A. wentii*, *Penicillium glaucum*, *P. italicum*, *P. africanum*, *Mucor mucedo*, *M. hiemalis*, *Fusarium solani*, *Saccharomyces ludwigii*, and *Actinomyces odorifer*. Possibly the stimulatory action of uspulun-universal on germination may be partially due to the elimination of pathogenic organisms from the seed.

GRAM (E.). **Nøgen Bygbrand.** [Loose smut of Barley.]—*Ugeskr. for Landmaend*, lxxiv, 10, pp. 152–153, 1929.

Of recent years loose smut of barley [*Ustilago nuda*] has been of little importance in Denmark, but the writer urges plant breeders to eliminate all trace of infection by a combined chemical and hot-water treatment. The seed-grain is presoaked in a solu-

tion of 0·1 per cent. germisan or tillantin [uspulun-universal] and then immersed in hot water [ibid., viii, p. 97].

SINNING (A.). **Versuche mit Trockenbeizen gegen die Streifenkrankheit der Gerste.** [Experiments with dusts against the stripe disease of Barley.]—*Deutsche Landw. Presse*, lvi, 13, p. 183, 1929.

Extending his previous experiments in the control of stripe disease of summer barley [*Helminthosporium gramineum*: *R.A.M.*, vii, p. 235] to the winter varieties, the writer again obtained excellent results with tillantin (150 gm. per cwt.), abavit B proving less reliable. The Primus dusting apparatus was used in the tests.

WINKELMANN (A.). **Infektionsversuche mit Helminthosporium gramineum.** [Inoculation experiments with *Helminthosporium gramineum*.]—*Angew. Bot.*, xi, 2, pp. 120–126, 1929.

Genau's method of artificial inoculation of barley with the causal organism of stripe disease (*Helminthosporium gramineum*) [*R.A.M.*, viii, p. 231] is considered unsuitable on the grounds that it does not conform to natural conditions. For some years the writer has adopted the following mode of procedure. The ears used in the inoculation tests [the results of which are tabulated] are brushed at the moment of flowering with spores direct from infected leaves. To determine the most favourable time for infection the ears were enclosed in parchment bags before emergence and examined daily by means of a flap cut in the bag. Inoculations were carried out at different periods after flowering began. In 1926 and 1927 the tests only extended until about four weeks after flowering, but in 1928 experiments (the results of which will be published later) were also conducted at subsequent dates.

The resulting data show that infection takes place, not only during or immediately after flowering but considerably later (over a month in some cases), and that the process is not restricted to any particular date. In view of these facts, Zade's term 'flower seedling infection' [cf. ibid., iii, p. 642] can no longer be applied to infection by *H. gramineum*. If it is considered desirable to distinguish between the latter type of infection and the typical seedling infection produced by *Tilletia* [*caries* and *T. foetens*], the term 'grain seedling infection' may be substituted.

Infection apparently takes place, not through the open flower, as suggested by Genau [loc. cit.], but by means of spores germinating under humid conditions on the exterior of the grain and thence penetrating the glume. The process, therefore, depends essentially on two factors: (1) the conditions governing spore germination, and (2) the resistance opposed by the glumes to the entry of the fungus.

KOSTERZ (W.). **Düngung als Brandbekämpfungsmittel. Eine praktische Beobachtung.** [Fertilizing for the control of smut. A practical observation.]—*Wiener Landw. Zeit.*, lxxix, 12, p. 103, 1929.

In 1923 the writer applied a fertilizer consisting of 100 kg. each

of ammonium sulphate, superphosphate, and 42 per cent. potash salt to a clay and sand field of oats following rye at the Oberhermsdorf (Austria) Agricultural College. The resulting oat crop remained completely free from smut [*Ustilago avenae*], which occurred in a severe form on a crop following horse beans [*Vicia faba* var. *minor*] in a field some distance away. The effect of the ammonium sulphate is attributed to an increase of the soil moisture in the vicinity of the seed-grain, thereby facilitating the absorption by the latter of the readily soluble salts, which accelerate germination.

KIRCHHOFF (H.). **Beiträge zur Biologie und Physiologie des Mutterkornpilzes.** [Contributions to the biology and physiology of the ergot fungus.]—*Centralbl. für Bakt.*, Ab. 2, lxxvii, 15–24, pp. 310–369, 22 figs., 1929.

In this paper the author discusses at considerable length the results of investigations during the period 1921 to 1925, at the Brunswick Botanical Institute, on the biology and physiology of the ergot fungus (*Claviceps purpurea*).

The undiluted honeydew was found to correspond to a 2·33 molar sugar solution. Comparative measurements on identical conidial material in undiluted and diluted honeydew showed spore dimensions of 3·5 to 6 by 2·5 to 3 μ and 6·5 to 7·5 by 4·2 to 4·8 μ, respectively. Thus the osmotic value of the surrounding medium has an important effect on the size of the conidia.

In addition to inoculation experiments on flowering ears of rye with ascospores and with natural conidia from honeydew [*R.A.M.*, ii, p. 114], a further series of tests was successfully carried out with conidia developed in culture. Observations showed that the principal seat of infection is neither the free part of the ovary wall nor the stigmas, but the point of insertion of the ovary. The epidermis of the lower half of the ovary was found to be largely covered by a continuous *Sphacelia* layer, at a time when loose mycelium had only penetrated to the lower part of the ovarial cavity and the exterior of the ovule was but slightly infected, the interior of the ovule and the upper part of the ovary being still quite free from the fungus. The germ-tubes do not, therefore, penetrate the upper ovary wall and pass by way of the ovule to the ovary base, but the spores germinating on the stigma produce long germ-tubes which encircle the exterior of the ovary in one to two days and then penetrate the tissue at the most susceptible point, viz., the base of the ovary.

On 8th June, 1922, i. e., 5 to 6 days before flowering, 174 flowers on nine ears were inoculated, after removing the glumes and exposing the stigma, with *C. purpurea*. After 18 days 140 (80·5 per cent.) showed infection, while the controls remained healthy; this proves that the ears are susceptible some time before flowering. In three other tests the ears were inoculated at flowering time, (*a*) on 12th to 14th June, 1922, with ascospores, (*b*) on 7th and 8th June, 1922, with honeydew, and (*c*) on 18th June, 1923, with conidia from pure cultures, resulting in 72, 82, and 36 per cent. infection, respectively. Positive results were further obtained by the inoculation of rye flowers up to 15 days after flowering.

Some particulars are given of the development and form of the sclerotia, and the factors governing this phase in the life-history of the fungus are discussed. In order to secure an appreciable percentage of sclerotial germination, low temperatures must have prevailed for at least 25 days prior to the test; the longer the duration of the low temperatures, the more rapidly does germination occur on the transference of the sclerotia to suitable temperatures. The maximum percentage of germination can only be induced by the protracted action (30 to 40 days) of temperatures close to zero. The minimum temperature for the actual germination process was found to be slightly above 10° and the optimum 18° to 22°.

A description is given of the various growth forms observed in artificial cultures. Sclerotia developed from smooth *Sphacelia* colonies on a 2 per cent. nutrient agar containing 0·1 per cent. monopotassium phosphate, 0·025 per cent. magnesium sulphate, 10 per cent. cane sugar, and 0·1 per cent. asparagin; in another series, in which asparagin was added at the rate of 1 per cent., growth was more luxuriant and sclerotial development more rapid and pronounced. Even better results were obtained by the addition of potash lye (sufficient to produce slight alkalinity of the medium) to the above media. The first sclerotia found in these cultures resembled the natural organs only in point of size; otherwise they approximated to microsclerotia in the unequal thickness of the pseudoparenchyma and the absence of the cortical layer, differing completely in external appearance from the bodies produced under natural conditions. In other respects the microscopic characters of natural and artificial sclerotia are entirely identical. Only the marginal zone (2 to 5 mm. broad) of the smooth *Sphacelia* colony is transformed into purple, later dull black sclerotial tissue. The formation of the artificially grown sclerotia was completed in two months.

Generally speaking, dextrose, levulose, galactose, cane sugar, glycogen, and mannite induced very good growth of *C. purpurea* at concentrations of 5 to 15 per cent., good at 1 to 3 per cent., and slight at 0·1 to 0·5 per cent. As the fungus is known to be capable of splitting saccharose, the reducing sugars present in the honeydew may either be transported to it as such, or may originate from saccharose through the action of the enzymes of the organism. Investigations have shown that these sugars are formed to some extent by the rye plant itself, but the composition of the sap indicates that a further splitting of the saccharose is effected by the fungus.

C. purpurea was found to be capable of utilizing all the various sources of nitrogen [which are enumerated] used in the tests. The fungus is known to possess a marked capacity for acidification of the medium, and special pains were taken to overcome this tendency (which is believed to prevent the development of the smooth *Sphacelia* colonies from which alone sclerotia subsequently were produced) by a judicious composition of the medium as indicated above. On media containing gelatine, large bodies (3 by 5 or 8 by 9 mm.) resembling incipient sclerotia were formed. The gelatine was liquefied by a peptonizing ferment, and a casein-

splitting ferment (possibly identical with the foregoing) was present. It was evident that the reaction of the medium is the essential factor in sclerotial formation. The latter can be ensured by the choice of media, the composition of which (especially with regard to the source of nitrogen) should guarantee that there shall be no production of free acid.

GRIFFITHS (MARION A.). **Smut susceptibility of naturally resistant Corn when artificially inoculated.**—*Journ. Agric. Res.*, xxxvi, 1, pp. 77–89, 4 diags., 1928.

This is an expanded account of the writer's investigations on the reaction of naturally resistant maize to artificial inoculation with smut (*Ustilago zeae*), a preliminary notice of which has already appeared [*R.A.M.*, vi, p. 412]. The material used in the field and greenhouse tests [which are fully described and the resulting data tabulated] consisted of seed of selfed lines of the Garrick, Cuban, and Boone County White varieties and crosses between them. A high percentage of infection (up to 100) was obtained in the normally resistant plants by the injection of conidial suspensions of the fungus into the apical and nodal bud tissues, immature ears, young leaves, and tassels [see next abstract]. The lines used in these experiments were susceptible to several individual smut collections from the Arlington (Virginia) Experiment Farm, as well as to mixed collections from this and other localities. Evidently, therefore, the susceptibility of the naturally resistant lines to artificial inoculation is not attributable to the use of physiological forms of the fungus from other places.

PLATZ (G. A.). **Some factors influencing the pathogenicity of Ustilago zeae (Beckm.) Unger.**—*Iowa State Coll. Journ. of Science*, iii, 2, pp. 177–200, 9 pl., 1929.

A survey of the incidence of maize smut (*Ustilago zeae*) near Ames, Iowa, in 1923 and 1927, showed that the disease was more prevalent in the latter year, when the mean temperature during the growing season was rather lower and the rainfall much less than in the former season. The mean temperature for June, 1923, was 71° F., for July 77·2°, and for August 70·1°; the corresponding figures in 1927 being 66·9° for June, 75·3° for July, and 68·4° for August. During the period June to August, 1923, there were 29 falls of rain yielding 13·79 inches, compared with 28 falls and only 3·92 inches of rain in the corresponding period of 1927. The development of maize smut was apparently favoured by the occurrence of relatively cool, dry weather in June followed by rain and higher temperatures [cf. *R.A.M.*, vii, p. 779].

From about 20th July onwards distinct, successive manifestations of smut were observed on the leaves, tassels, nodes, and eventually on the ears. Infection of the axillary buds at the nodes, however, was more common than that of any other part of the plants. Most of the smut was limited to individual, specific parts of the plants. In 67·1 per cent. of 627 diseased individuals, only one part of the plant was attacked; in 32·9 per cent. two or more parts of the stalk were infected; and in 1·8 per cent. the

entire top was involved, so that specific points of invasion could not be determined [ibid., iv, p. 603].

Leaf infection may be manifested in various ways. The diseased areas may consist of small, irregular, yellow blotches with occasional dark red spots. The infected portion of the leaf is often crinkled, so that its surface is wavy instead of flat. A common symptom of leaf smut is the entire necrosis of the infected tissues and the tearing or dropping out of the diseased portion. The chlorotic areas, on the other hand, may entirely disappear in older leaves. Relatively small smut boils may also be produced on the leaves.

Inoculation experiments indicated that plants 1 to 1½ ft. tall are more susceptible to infection than either smaller ones, up to 10 inches in height, or larger individuals (2 to 4 ft.). In the smaller plants the growing tips are too deeply seated and protected to be easily reached by the spores, while in plants more than 2 ft. tall the exposed surfaces are probably covered by an impenetrable epidermis.

Greenhouse experiments showed that the sweet variety, Golden Bantam, is more susceptible than Reid's Yellow Dent (strain Iodent No. 25), which in turn was less resistant than Japanese Hull-less popcorn. Inbred strains of Dent varieties that had not developed smut in the field for several years did not show the same degree of resistance in the greenhouse when a sporidial suspension was dropped into the terminal leaf-spiral of the plants [see preceding abstract]. This mode of infection proved more successful than dusting the leaf-spirals with chlamydospores or spraying them with a sporidial suspension. Artificial infection of maize was favoured by temperatures ranging from 20° to 35° C. and by high relative humidity. Young ears were readily infected by dropping sporidial suspensions of the fungus into their distal ends.

Gumming of Lemons. Treatment of affected trees.—*Fruit World of Australasia*, xxx, 3, pp. 94–95, 1929.

During recent dry weather a gumming or collar rot associated with a species of *Phomopsis* was prevalent on citrus trees, especially old lemons, in New South Wales. Patches of bark on the trunk or limbs are killed and often much gum is exuded. Infection usually starts at soil level and works up and round the trunk, the fungus girdling the tree if left unchecked.

Except in the centre of old lesions the disease is confined to the outer bark: treatment consists in cutting away the diseased tissues with an inch or two of apparently healthy margin, and painting the wound with Bordeaux paste or paint. A Stockholm tar compound which allows the wound to heal rapidly is recommended for large lesions. Inarching may also be adopted in severe cases.

Venkatarayan (S. V.). **How to distinguish between the stem bleeding disease and anabe roga of Cocoanuts.**—*Mysore Agric. Calendar, 1929*, pp. 13, 17, 1929.

Attention is drawn to the fact that the chief symptom of the so-called 'stem bleeding' disease of coco-nuts (*Thielaviopsis paradoxa*)

[*R.A.M.*, vii, p. 629], viz., bleeding, is also characteristic of 'anabe roga', caused by *Ganoderma lucidum* [ibid., vii, p. 718], and to the consequent risk of confusion between these two disturbances. The following features serve to distinguish them in Mysore.

In the true stem bleeding disease, the exudation is confined to one part of the trunk. The underlying tissue shows a yellowish to brown discoloration, and the patch exudes a rapidly drying juice containing the hyphae and spores of *T. paradoxa*. The bleeding patches usually occur at a height of 3 to 6 ft., but sometimes they are found at 20 to 25 ft. Affected trees above the age of 10 to 12 years are rarely killed by this disease, though in severe cases the yield may be reduced.

In the anabe roga disease, the bleeding patches are smaller and more numerous, and they occur all round the trunk, usually in the basal portion (up to 8 ft. from the ground). This is primarily a root disease, and the fungus has completely pervaded the tissues of the roots and the base of the trunk before the exudation begins. The disease results in a diminution in the size of the crown, the lower leaves of which turn yellow and droop; this unmistakable symptom is absent from the true stem bleeding disease. The typical fruit bodies or 'anabes' are not always formed on standing trees, but they develop soon after felling on the infected stumps.

The anabe roga disease is much more deadly than stem bleeding, and the destruction of infected trees is the sole remedy. The sites on which such trees have grown should be isolated from adjacent healthy areas by means of trenches 2 ft. deep and 2 ft. wide. The trenches and the holes from which the trees were uprooted should be liberally sprinkled with air-slaked lime, and at least a year should elapse before replanting. Any sporophores formed on the old wood should be destroyed. In the true stem bleeding disease it is sufficient to excise the bleeding patches and apply hot tar to the wounds, after flaming the latter.

VANDENBERG (S. R.). **Report of the Entomologist.**—*Rept. Guam Agric. Exper. Stat. 1927*, pp. 12–17, 1929.

Only four cases of coco-nut bud rot (*Phytophthora faberi*) [*P. palmivora*: *R.A.M.*, viii, p. 527] were found during the period under review. A disease of coco-nuts, characterized by physiological disturbances and known locally as 'tinangaja', has given evidence of being infectious, and an order issued by the Governor of Guam in January, 1927, required the destruction of all affected trees by 15th March. The symptoms of this disturbance, the cause of which is unknown, include the withering and drooping of the lower leaves, followed gradually by those nearer the tip until the whole top is dead; a gradual diminution in the diameter of the trunk, with a corresponding decrease in the size of the top and in the number and size of the nuts; and the withering and death of the flower bracts in the middle stages of the disease. Eventually only two or three stunted, yellow leaves remain at the top of a trunk reduced to a diameter of 2 to 3 inches, and this condition persists until the top dies or is blown off.

CHABROLIN (C.). **La pourriture de l'inflorescence du Palmier-dattier (Khamedj).** [Rot of the inflorescence of Date Palms (Khamedj).]—*Comptes rendus Acad. des Sciences*, clxxxviii, 13, pp. 933–935, 1929.

The author states that the inflorescence rot of the date palm (*Phoenix dactylifera*) caused by *Mauginiella scaettae* [*R.A.M.*, vi, p. 598] has been observed by him both in the neighbourhood of Tunis and in the oases to the south, and that it is identical with the diseases locally known under the names of 'khamedj' (vernacular for rot) and 'doudah', but distinct from 'baioudh' [loc. cit.]. Infection occurs externally through the uninjured spathe, while the latter is still entirely hidden by the leaf sheaths. The affected tissues turn brown, and the resulting spot finally spreads over the greater portion of the spadix, which then usually fails to emerge from its sheath. Once infected the whole inflorescence is practically doomed to entire destruction. The mycelium develops both within the tissues and in the spaces between the elements of the young inflorescence, where it forms an abundant white felting. The internal mycelium develops mainly in the parenchymatous tissues, and only invades the vascular bundles in the later stages of the disease.

M. scaettae was grown in pure culture on various media, on which, as well as on its natural substratum, it only produced conidia. The generic name *Mauginiella* suggested by Cavara is accepted by the author, who, however, points out the affinity of this fungus with the genera *Septocylindrium* Bonord. and *Geotrichum* Link. Revised diagnoses (in French) of the genus and of *M. scaettae* are appended.

The rot caused by this fungus is specific to the date palm, and does not attack the inflorescences of *P. canariensis*. It is of a certain economic importance, since the losses due to it frequently amount to 5 (occasionally 10) per cent. of the crops. Experiments indicated that the disease may be controlled by dusting the terminal bud with a mixture of 25 per cent. powdered copper sulphate and 75 per cent. slaked lime, while good results have also been apparently obtained by a preventive treatment of the terminal buds with a lime-sulphur spray.

MARTYN (E. B.). **The Sclerotium disease of Coffee, and its occurrence in this Colony.**—*Agric. Journ. Brit. Guiana*, ii, 1, pp. 7–10, 2 pl., 1929.

The disease of coffee caused by *Sclerotium coffeicolum* [*R.A.M.*, viii, p. 443] in British Guiana is stated to be limited to the North West District of that colony, where it was recorded for the first time about 1912. Its origin is uncertain, but what is apparently the same fungus occurs quite commonly on the leaves of young *Cecropia peltata* plants growing as weeds on the outskirts of coffee plantations. It attacks chiefly the Liberian types, but has been found on a few bushes of *Coffea arabica* and on *C. deweveri* in the affected region of the colony. The principal damage is due to the infection of the berries, which shrivel up and fall, and of the flowers and flower cushions, which are killed. Trees of all ages are

attacked, the older ones being usually the most widely and severely affected; in 8- to 10-year-old plantations the incidence is very variable. The losses caused by the disease do not appear to be, on the whole, above 15 to 20 per cent. of the total crop, but may reach in some cases as high as 50 per cent.

The control measures recommended are based on the work done by Stahel in Surinam [ibid., i, p. 14], and consist in the immediate removal and destruction of all débris from infected trees, and in the application of 2 per cent. Bordeaux mixture. Coffee trees should also be more widely spaced than is customary at present, and more attention given to pruning.

HANSFORD (C. G.). **Cotton diseases in Uganda, 1926–1928.**—*Empire Cotton Growing Review*, vi, 1, pp. 10–26; 2, pp. 160–167; 3, pp. 240–245, 1929.

An account is given of the symptoms, causes, distribution, severity, and control of the principal parasitic diseases of cotton observed in Uganda from 1926 to 1928, inclusive. Sore shin (*Rhizoctonia* (*Corticium*) *solani*) [*R.A.M.*, vii, p. 702] is stated to be very troublesome both in cool, wet weather, and in dry periods such as prevailed during most of the planting season in 1927. Angular leaf spot (*Bacterium malvacearum*) [see next abstracts], as indicated by field observations and experimental inoculations, is not at present of any great economic importance in Uganda except after periods of wet, cool weather, while the blackarm form of the disease appears to be entirely dependent on injury to the tissues of the stems for its development. In one locality, however, Egyptian and Sea Island cotton suffered very badly from both forms, and there was evidence that smooth-leaved varieties are more susceptible than the hairy ones. Areolate mildew (*Ramularia areola*) is very common, but the damage done by it appears to be insignificant. Other fungi known to occur on cotton leaves in Uganda are *Mycosphaerella gossypina* (stated to have a *Septoria* as its imperfect stage) and *Alternaria macrospora* [ibid., vii, p. 702], both of no practical importance under normal conditions. Root rot of mature plants is caused by *Rhizoctonia bataticola* [*Macrophomina phaseoli*] which, in pure culture, was found to be a different strain from that found on other woody hosts, having much smaller sclerotia. The possibility of the existence in Uganda of two or more distinct forms, or allied species of fungi is being investigated. The disease is sporadic, and plants adjacent to those killed by it often remain perfectly healthy. *Fusarium vasinfectum* is stated to be frequently, but not always, associated with a wilt which is occasionally observed in cotton fields; there is some doubt, however, whether the fungus actually causes this wilt under Uganda conditions, the more so since fairly severely wilted plants have been known to recover.

Internal boll rot (*Nematospora gossypii*) [loc. cit.] is believed to cause greater loss of crop in Uganda than any other disease. Inoculation experiments [details of which are given] showed that when a spore suspension was introduced by a hypodermic syringe into the lock cavity infection resulted in every case, while 45 per cent. of the inoculations succeeded when the bolls were pricked

with a very fine needle penetrating through the boll wall after spraying the latter with the spore suspension; in this case a proliferation of the internal tissues of the boll walls occurred, similar to that caused by the attack of cotton stainers (*Dysdercus* spp.). No infection was produced when the bolls were superficially pricked with a needle either before or after the application of the spore suspension. Field observations, supported by the evidence supplied by numerous (though as yet not entirely conclusive) infection experiments with *Dysdercus nigrofasciatus* in 1928, lead the author to believe that there exists a close association of the fungus with the insect, and that the latter carries the former from boll to boll in the field. Field observations during the abnormally wet season of 1926–7 and the abnormally dry season of 1927–8 appear to indicate that the boll rot caused by *Bact. malvacearum* is at present of secondary economic importance in Uganda; while its distribution is almost universal, the number of bolls affected is usually insignificant. Among the numerous other fungi and bacteria which have been isolated from the interior of diseased bolls, the following were shown by inoculation experiments to be wound parasites, capable under certain conditions of causing a boll rot: *Alternaria macrospora*, the infection with which of unopened bolls in the field is of very rare occurrence and is apparently dependent on external damage caused by the spiny bollworm (*Earias* sp.); *Rhizopus nigricans*; *Gibberella moniliformis*; and a species of *Fusarium* of the *Elegans* section. Of the nine strains of yellow bacteria (besides *Bact. malvacearum*) isolated [a brief cultural description of which is given], six were found to be pathogenic when introduced inside the boll cavity by a hypodermic syringe or by needle pricks penetrating through the boll walls. In the field, bacterial rots of the interior of cotton bolls are less common than the *N. gossypii* rot, the relative frequency being roughly 30 or 40 : 1.

Several abnormalities of the cotton boll are described, mostly dependent on weather conditions. Small dark brown corky scabs, usually almost circular, hard, and measuring from 0.5 to 1·5 mm. in diameter, often form on the boll wall. They are thought to result from superficial injury by small sucking insects. In very moist weather they become infected by a greyish-white bacterium which causes the living cells below to proliferate; the remains of the corky scab are then raised by a loose aggregation of large, almost spherical, thin-walled, hyaline cells, with bacterial slime in the intercellular spaces.

Neither *N. gossypii* nor any other organism has ever been found in the wall tissues around the insect punctures or in the proliferated tissue that is so frequently the result of these punctures, the first apparent symptom of *N. gossypii* attack always developing on the surface of the lint below the proliferating tissue. This supports the view that the spores are actually conveyed by the insect into the interior of the boll. Seeds infected by *N. gossypii* very rarely germinate, owing to the rapid growth of the fungus during the preliminary stage of germination.

Besides *N. gossypii* the author isolated the following organisms from the interior of cotton seeds: *Gibberella moniliformis*, *Fusa-*

rium sporotrichioides, *F. acuminatum*, *F. anguioides*, *F. diversisporum*, *Cladosporium herbarum*, *Alternaria* sp., *Bact. malvacearum*, a yellow species of *Bacterium* identical with two cultures isolated from cotton bolls, *Chaetomium* sp., *Aspergillus tamarii*, *A. sydowi*, two species of *Penicillium*, *Nigrospora oryzae*, and *Cephalosporium* sp. Of these, the bacteria, *N. gossypii*, and *G. moniliformis* are found in seed showing no evidence of superficial damage to the testa. Seed infected with *Bact. malvacearum* and the other yellow bacteria may germinate or not, depending on the site and extent of the infection. When this is limited to small spots on the cotyledons, the seed germinates normally, the spots being visible on the cotyledons as they emerge from the soil. Under suitable weather conditions the infection may subsequently spread from these spots to the young leaves as these are formed. When the seeds are infected in the radicle, i. e., at the micropylar end (about 50 per cent. of the seed internally infected with *Bact. malvacearum* belongs to this class), the seed does not germinate. Infections located only in the cotyledons appear to be entirely independent of the micropyle, and are in all probability associated with insect punctures on the mature seed, either before or after ginning. Usually only a single infection is found on each seed attacked.

MASSEY (R. E.). **Blackarm disease of Cotton. The development of Pseudomonas malvacearum E. F. Smith within the Cotton plant.**—*Empire Cotton Growing Review*, vi, 2, pp. 124–153, 12 graphs, 1929.

Details are given of the investigations on the angular leaf spot and blackarm disease of cotton (*Pseudomonas* [*Bacterium*] *malvacearum*) in the Sudan since the publication of the author's previous paper on it [*R.A.M.*, vii, p. 95]. In giving the main histological features of the disease from its inception in the infected seed after sowing, it is stated that the spread of the bacterium in the seedlings and subsequently in the adult plants is never truly vascular; it passes through the tissues external to the vascular strands, chiefly through the intercellular spaces of the cortical parenchyma. The presence of enzymes capable of destroying the middle lamella of the cell wall was, however, demonstrated, and it is also thought that a cytase is probably excreted, since the parenchymatous tissue is definitely destroyed in the path of the invading organism, the bacteria first entering the cells from the corner adjoining an intercellular space. From the cotyledons, which become infected while still enclosed in the seed, the organism rapidly passes via the cortical parenchyma into the corresponding tissue of the first node of the main stem, and as long as climatic conditions remain favourable, each developing organ of the elongating stem is infected in turn. The endodermis of the stem is destroyed for some distance in advance of a lesion, thus affording a free passage upwards to the bacteria. In the Sudan the developing ovule is attacked at an early stage, as the base of the developing boll presents a very favourable substratum for intensive growth of the parasite, owing to its richness in sugars. The only organs which, so far, have not been observed to harbour the bacterium are the anthers. The progress

of the disease within the plant may be, at any time, checked by external factors, such as excessive heat or cold, or the replacement of the parenchyma by suberized tissue. A direct correlation was also found between the localization of the parasite and the available food supply within the host tissues, and in this connexion it is stated that heavily infected seed germinated and kept in darkness produced seedlings showing no trace of infection after twelve days, while lesions appeared when photosynthesis began after exposure to light.

Controlled laboratory experiments on the effect of soil temperature on the development of the disease [which are fully described] confirmed the results of the previous work [loc. cit.], but indicated that the immunity obtained at 30° C. may be apparent only, and that definite immunity does not occur under 32°. Induced waterlogging of the infected tissues (by smearing the leaves and cotyledons with vaseline) greatly promoted the development of the disease, the injurious effect of rainfall being explained in a similar manner.

In describing the field experiments in 1927 and 1928 in the three main cotton-producing centres of the Sudan (Tokar, Kassala, and the Gezira), the author discusses the value of dry land farming and the effect of sowing the crop at different periods of the year. He particularly stresses the point that a high degree of moisture in the surface layers of the soil is not necessary for successful germination, but is extremely harmful from the point of view of the blackarm disease. A wet soil is a cold soil, while one that is merely moist can be made to store up large quantities of heat. By carefully watering the soil during July and the first half of August, and by allowing it to absorb heat, the cooling effect of rain can be largely nullified, so that even with normally infected seed the disease can be commercially controlled. In the Sudan the disease is mainly spread in the field by rain and wind, which also stimulate the parasite in the host tissues by creating favourable environmental conditions.

In discussing control measures, it is pointed out that seed disinfection with chemicals is unattainable, since the parasite is too deeply located within the tissues of the resting seed. Promising results, however, were obtained by subjecting the seed for five hours to dry heat at 95° C., or for from 48 to 72 hours at 85°, the latter treatment being the more efficient of the two, and having the further advantage of not impairing the germinability of the seed. It is stated, however, that watery lesions caused by an organism distinct from *Bact. malvacearum* may appear on the cotyledons of seedlings grown from heated seed, when germination is carried out at a low temperature. Inoculations of cotton stems with this bacterium gave negative results.

No variety of cotton has yet been found in the Sudan which is entirely resistant. In the Gezira the disease is a constant menace; at Kassala initial infection followed by recovery is the rule; while at Tokar, owing to climatic factors, little or no infection is ever found. The latter fact renders Tokar very suitable as a propagation area for clean seed.

MASSEY (R. E.) & HATTERSLEY (M. C.). **Blackarm disease of Cotton.**—*Empire Cotton Growing Review*, vi, 3, pp. 248–249, 1929.

A brief account is given of the yellow bacterium, distinct from *Bacterium malvacearum*, referred to in the senior author's previous paper [see preceding abstract], which is stated to have since been found in constant association with the latter in natural infections of the cotton plant with the blackarm disease in the Sudan. The two organisms are morphologically similar in the early stages of their growth on nutrient agar, but are dissimilar in the character of the colonies on solid media and in their response to the addition of various sugars to liquid media [a comparative table of the reaction to sugars of the two strains being given]. The colour of *Bact. malvacearum* on all solid media is a pale yellow, while that of the second organism is a rich yellow, and in old normal mixed cultures the former frequently overruns the latter.

Pure cultures of the dark yellow organism proved to be non-pathogenic when inoculated by needle pricks in the succulent tissue of the upper stem of cotton seedlings, while pure cultures of *Bact. malvacearum* proved to be more virulent than the mixed cultures usually isolated from naturally infected plants.

FAHMY (T.). **The Fusarium disease of Cotton (wilt) and its control.**—*Min. of Agric. Egypt (Plant Protect. Sect., Mycol. Res. Div.) Leaflet* 11, 8 pp., 8 figs., 1929.

This is a condensed popular account of the author's investigations on the *Fusarium* disease of cotton in Egypt [*F. vasinfectum* var. *egyptiacum*], full particulars of which have already been given from other sources [*R.A.M.*, vii, p. 781].

Part III. Plant Protection Section, 1925–1927.—*Sixth Rept. Min. of Agric. Egypt, Cotton Res. Board, 1925–27*, pp. 71–81, 1929.

This report contains, in addition to information already noticed from other sources, the following items of phytopathological interest. Among the strains of cotton selected for resistance to wilt (*Fusarium vasinfectum* var. *egyptiacum*) [see preceding abstract], one known as E is particularly promising.

Sore shin, associated with *Fusarium*, *Rhizoctonia*, and *Rhizopus* spp., bacteria, and nematodes [*R.A.M.*, iii, p. 648; iv, p. 130; v, p. 19], was controlled to some extent by the application of abavit, germisan, or uspulun in the form of a soil dressing. Such an effect is only possible, however, when weather conditions are fairly favourable to the development of the seedlings, and need not be expected in seasons when the temperature is continuously sub-normal during germination and early growth.

PAILLOT (A.). **La symbiose bactérienne et l'immunité humorale chez les Aphides.** [Bacterial symbiosis and humoral immunity in Aphids.]—*Comptes rendus Acad. des Sciences*, clxxxviii, 17, pp. 1118–1120, 3 figs., 1929.

After a brief reference to Büchner's and Peklo's studies of the symbiotic organisms present in aphids, the author states that his

Giemsa smears prepared from the internal organs of *Eriosoma lanigerum* revealed the existence of very characteristic transition forms from rounded yeast-like cells to filamentous forms. These transitional forms resemble bacilli with a swelling in the middle or at one end; occasionally round forms with a filiform appendage in process of resorption were found.

The symbiont of *Aphis rosae* is very similar to a *Staphylococcus*. Giemsa smears showed the simultaneous presence of isolated cocci, diplococci, rounded masses, and of transition forms represented by cocci of an increasing size, all of them obviously belonging to the same organism.

The above facts, as also those observed in the case of some other aphids studied, are considered to confirm Peklo's views as to the bacterial nature of the symbiotic organism [cf. *R.A.M.*, v, p. 31]. They indicate, however, that the symbiotic bacteria are of different groups, and not only *Azotobacter*, as Peklo believed. On the ground of these observations and of the results obtained in inoculation experiments, the author considers that the condition found in the aphids is a consequence of a form of humoral immunity which leads to a condition of stable equilibrium between insect host and bacterial parasite. Some recently observed facts appear to indicate that this equilibrium may be accidentally disturbed, in which case the symbiotic bacterium may become an active parasite.

BUCKLEY (J. J. C.) & CLAPHAM (PHYLLIS A.). **The invasion of helminth eggs by Chytridiacean fungi.**—*Journ. of Helminthology*, vii, 1, pp. 1–14, 1 pl., 21 figs., 1929.

An investigation was made of two fungi, *Catenaria anguillulae* and *Rhizophidium carpophilum*, found in a parasitic form on the eggs of *Dibothriocephalus latus* in the Department of Helminthology, London School of Hygiene and Tropical Medicine, in March, 1927. The eggs of a mite, *Rhizoglyphus echinopus*, accidentally introduced into the *D. latus* cultures, were also observed to be infected.

Morphologically the *D. latus* egg form of *C. anguillulae* is identical with that described recently as occurring in the eggs of the liver-fluke (*Fasciola hepatica*) [*R.A.M.*, vii, p. 172], but the former is distinguished by the production of structures believed to be resting spores. These bodies are formed simply by the contraction of the finely granular contents of an ordinary sporangium into a roundish or oval mass, which is later invested by a thick wall. They vary in size from 12 to 65 μ. On germination the thick wall bursts, and the thinner inner lining protrudes through the crack and develops into a tube of discharge similar to that formed by the sporangia.

Alluding to the possibility of using *C. anguillulae* in the control of endemic helminthiasis, the writers state that the relatively thin-shelled eggs of *D. latus*, *D. mansoni*, and *F. hepatica* were readily infected in laboratory tests. Infections were also obtained in the eggs of *Parascaris equorum*. Similar results were obtained with *R. carpophilum*, the delicacy of which, however, renders it unsuitable for practical purposes.

The life-cycle of *C. anguillulae* usually takes at laboratory

temperature not less than four days, but this period is curtailed under certain conditions, e.g., at higher temperatures (37° C.), while two days were found to suffice for the development of the fungus in the eggs of *P. equorum*. The percentage of infection secured on ova of *F. hepatica* after eight days' contact with *C. anguillulae* were as follows: 21·6 and 62·1 in two cultures in distilled and tap water, respectively, and 16·8 per cent. in a culture in septic water containing many protozoa and bacteria. It is evident from these data that the development of the fungus is considerably retarded in septic water. The sporangia of *C. anguillulae* failed to survive desiccation for a period exceeding 120 hours, and they were also killed by exposure to low temperatures (4° to 8°). The life-cycle of *R. carpophilum* was found to be much more rapid, 65 per cent. of the ova of *D. latus* being infected four days after sporulation.

GOODRICH (HELEN P.). **Reactions of Gammarus to injury and disease, with notes on some microsporidial and fungoid diseases.**—*Quart. Journ. Microscop. Sci.*, lxxii, 2, pp. 325–353, 1 pl., 1928.

Since May, 1923, the writer has kept numerous specimens of the fresh-water amphipod, *Gammarus pulex*, under observation in the laboratory of the Oxford University Museum (Department of Zoology and Comparative Anatomy).

A yeast, *Cryptococcus gammari* (described by Vejdovsky in *Centralbl. für Bakt.*, Ab. 2, vi, p. 577, 1900, and others as a bacterium) causes a disease of these animals which may prove fatal, though it is sometimes cured by phagocytosis and autotomy. The yeast varies considerably in size, the oval forms attaining a length of 10 μ while the rod-shaped ones generally measure 8 to 12 μ.

The spores of *Nosema* [*Actinomyces*] and a protozoon occasionally destroy a muscle-fibre of *Gammarus*, and this fibre may then be attacked by phagocytes which, as with *C. gammari*, secrete a chitinoid substance round the spores and destroy them. A similar chitinoid substance (black or pathological chitin) by which wounds are closed in *Gammarus* is also a product of its leucocytes. This substance is not chemically identical with the true chitin secreted by the epidermis of the amphipod. The yeasts undoubtedly remain alive and infective for a considerable time in the *Gammarus* corpses left in the water. Fresh hosts are not, as a rule, infected through the mouth and alimentary canal, but directly through wounds, especially during moulting. When the animals fail to combat the infection by autotomy, or the rejection of diseased appendages, the yeasts circulate with the blood all over the body until finally the aorta and its branches become distended and apparently blocked with parasites and the necrotic phagocytes containing them.

MAZZETTI (G.). **Comportamento del Penicillium brevicaule nelle diluizione della miscela moschicida 'miafonina' (metodo Berlese).** [Behaviour of *Penicillium brevicaule* in dilutions of the fly-killing mixture 'miafonina' (Berlese's method).]—

Atti R. Accad. Fisiocritici Siena, Ser. X, iii, 8–9, pp. 1055–1062, 1 pl., 1929.

Objections have been raised to the widespread use against the common house fly in Italy of the compound known as 'miafonina' on account of its high arsenic content (47 per cent.). A series of growth tests [which are fully described] was accordingly made with the common 'arsenical mould', *Penicillium brevicaule* [which is known to possess the property of liberating arsenic from arsenical compounds], in culture on potato with 1 to 50 per cent. of the insecticide in solution. It was found that the development of the fungus was completely inhibited by concentrations of miafonina exceeding 5 per cent., and as this compound is ordinarily used at a strength of 10 to 20 per cent., the risk of injury to health through the inhalation of the arsenical fumes given off by this and other common moulds may be considered negligible.

SPRING (DOROTHY). **Comparison of seven strains of organisms causing blastomycosis in man.**—*Journ. Infect. Dis.*, xliv, 3, pp. 169–185, 5 figs., 1929.

Comparative studies have been carried out on seven strains of *Blastomyces* [*R.A.M.*, viii, p. 103] from various sources [which are indicated] over a period of several years. All the organisms were responsible for different forms of blastomycosis in Gilchrist's sense of the term.

Material differences were observed between the various strains in regard to their morphological, cultural, and physiological characters. Strains 1 to 5 possessed narrow, segmented, sparsely branched, hyaline hyphae, producing single terminal conidia; strain 2 was characterized by large terminal and intercalary chlamydospores. In strain 6 many of the hyphae became thick-walled and were associated with particularly large and dense chlamydospores. The hyphae of strain 7 were broad and with sharply demarcated segments. Numerous arthrospores occurred in the older parts of the mycelium, while small terminal chlamydospores and ovoid, greenish sclerotia were also present. The terminal portions of many of the hyphae were constricted into one, two, or three conidia, bringing the species very close to *Scopulariopsis* and thus to *Penicillium brevicaule* [see preceding abstract].

All the strains except 7 were able to withstand exposure to a temperature of 48° C. for twenty minutes. The growth of all except 5 and 7 was inhibited by brilliant green at 1 in 10,000; strain 7 also resisted crystal violet at the same strength. Strains 2, 3, and 6 were susceptible to both dyes also at weaker concentrations. Gentian violet was less effective. The yeast cells found in the pus were as sensitive to the action of the dyes as those in culture.

Generalized infection as a result of inoculation occurred in few of the laboratory animals used in these experiments, except mice. It was difficult for the organisms to secure a foothold at all in rabbits, and only slightly less so in guinea-pigs.

CASTELLANI (A.). **Mannitol agar in the differentiation of the fungi of the type Blastomyces.**—*Proc. Soc. Exper. Biol. & Med.*, xxvi, 7, p. 544, 1929.

The author states that after two to three weeks' incubation at 26° C. on agar with 4 per cent. mannitol some species of *Blastomyces* [see preceding abstract] constantly produce a black pigmentation, while others do so only occasionally, and others again never. The first group includes *Blastomycoides immitis*, the second *B. dermatitidis*, and the third *B. tulanensis*.

CASTELLANI (A.). **A mannitol fermenting Monilia.**—*Proc. Soc. Exper. Biol. & Med.*, xxvi, 7, pp. 544–545, 1929.

None of the species of *Monilia* (numbering over thirty) hitherto known ferments mannitol. The author recently isolated, from the sputum of a patient suffering from chronic bronchitis, a Gram-positive, non-acid-fast species of this genus characterized by the production, on glucose agar, of free yeast-like cells and a certain amount of mycelium. The organism does not liquefy gelatine. It ferments mannitol, glucose, galactose, maltose, levulose, and dextrin, with formation of gas, and produces acid from arabinose and xylose. The name of *M. mannitofermentans* is proposed for this fungus.

BECK (M. D.). **Occurrence of Coccidioides immitis in lesions of slaughtered animals.**—*Proc. Soc. Exper. Biol. & Med.*, xxvi, 6, pp. 534–536, 1929.

During the course of an epidemiological investigation of coccidioidal granuloma, 38 lesions from slaughtered animals were examined. The lesions appear to be localized in the lymph glands of the upper respiratory tract. *Coccidioides immitis* [*R.A.M.*, vii, p. 719] was isolated from seven lesions (six on cattle and one on sheep) and inoculated into guinea-pigs with positive results.

Although very little is known concerning the mode of infection of coccidioidal granuloma, it seems unlikely that human beings are infected from animals, the indications being rather that both are infected from a common source.

HOSMER-ZAMBELLI (F.). **Un caso di enterite con reperto di Cryptococcus hominis.** [A case of enteritis with detection of *Cryptococcus hominis.*]—*Atti R. Accad. Fisiocritici Siena*, Ser. X, iii, 8–9, pp. 973–988, 2 pl., 1929.

Full clinical details are given of a fatal case of enteritis in a 14-months-old Italian infant. A post-mortem examination revealed the presence, in the affected intestinal organs, of *Cryptococcus hominis* [*R.A.M.*, vi, pp. 112, 614]. Inoculation experiments on rats gave positive results, and it is concluded that the fungus was at least partially responsible for the infant's condition.

BARONI (B.). **Sur un milieu de culture pour le développement et la conservation des champignons pathogènes.** [On a culture medium for the development and conservation of pathogenic fungi.]—*Comptes rendus Soc. de Biol.*, c, 12, pp. 994–995, 1929.

The writer has obtained very satisfactory results in the growth

and conservation of cultures of *Actinomyces asteroides eppingerii*, *Oospora d'agatae*, *Sporotrichum beurmanni*, and *A. bovis albus* on a medium consisting of 300 gm. of lean beef or horseflesh per 1,000 c.c. of distilled water, 5 gm. of sea salt, 12 gm. of peptone, 18 gm. of agar, 15 gm. of commercial cacao, 5 gm. of absolutely pure cacao butter, and 60 gm. of glucose. Full directions are given for the preparation of this medium, which enables the fungi to retain (or if necessary to reacquire) their original virulence.

KADISCH (E.). **Über die Bedeutung der Nährbodenalkalität in der Mykologie.** [On the importance of the alkalinity of the nutrient medium in mycology.]—*Dermatol. Zeitschr.*, lv, 5–6, pp. 385–396, 10 figs., 1929.

A series of experiments [the results of which are discussed and tabulated] was carried out to determine the effects of varying hydrogen-ion concentrations of the nutrient medium on the growth of a number of dermatophytes, including several species of *Epidermophyton* and *Trichophyton*, *Achorion quinckeanum*, and *A. schoenleini*. It was found that, on the four media used (Grütz-glycerine, Grütz-malt, Sabouraud-maltose, and 3 per cent. peptone) [*R.A.M.*, vii, p. 634], the best growth was made between P_H 7·2 and 7·6. Pigmentation in *T. rosaceum* and *T. purpureum* occurred only within these limits. Marked changes were induced in the appearance of the cultures by modifications in the hydrogen-ion concentration of the media.

MALLINCKRODT-HAUPT (ASTA V.). **P_H Messungen bei Pilzkulturen.** [P_H measurements in fungus cultures.]—*Dermatol. Zeitschr.*, lv, 5–6, pp. 374–384, 1929.

Particulars are given of a series of tests to determine the modifications in the hydrogen-ion concentration of a maltose-peptone nutrient medium induced by the growth of various fungi. After several months' culture at room temperature, *Trichophyton gypseum* [*R.A.M.*, viii, p. 446] was found to have changed the reaction from between P_H 6·01 and 7·19 to between 7·64 and 8·27, the corresponding figures for *Achorion quinckeanum* being 6·01 to 7·19 (initial) and 7·27 to 8·30 (end). *A. schoenleini* also made the medium change towards alkalinity. The change in these cases was accompanied by fermentation and a rise in surface tension. On the other hand, a change in the direction of acidity (P_H 6·8 to 5·63) was effected by *Sporotrichum beurmanni* [ibid., vii, p. 638] and some other fungi.

DE CASTRO (A. M.). **Tinhas dos animaes domesticos em São Paulo.** [Ringworms of domestic animals in San Paulo.]—*Arch. Inst. Biol. Defesa Agric. e Animal*, i, pp. 201–216, 7 pl., 1928. [English summary. Received June, 1929.]

In connexion with a systematic study of 320 cases of human ringworm in San Paulo, Brazil, the author makes some observations on the species of undoubted animal origin, viz., *Microsporon felineum*, *M. lanosum*, *Trichophyton gypseum asteroides*, and *T.*

granulosum, and on those probably originating from this source, namely, *T. lacticolor*, *T. rosaceum*, and *T. cerebriforme*.

Microsporon felineum was found to predominate in the causation of human ringworm in San Paulo (121 cases out of the 320 examined); 52 were due to *Achorion schoenleini*, 40 to *Epidermophyton inguinale*, 29 to *T. violaceum*, and the remainder to different species of *Microsporon*, *Trichophyton*, *Achorion*, and *Epidermophyton* [which are enumerated].

A detailed account is given of six cases of ringworm caused by *M. felineum* (five in cats and one in a dog), and of one case of a dog infected by *M. lanosum*. The cultural and morphological characters of these two fungi are fully described, and notes are given on the positive results obtained with them in inoculation experiments on guinea-pigs.

WILENCZYK (A.). **Sur la formation des asques mûrs dans les teignes.** [On the formation of mature asci in ringworms.]—*Comptes rendus Soc. de Biol.*, c, 13, pp. 1145–1146, 1 fig., 1929.

Continuing his experiments in the cultivation of the ringworm fungi [*R.A.M.*, vii, p. 241; viii, p. 173], the author found that the ordinarily very slow formation of the organs that he has described as asci in *Trichophyton granulosum* and *T. equinum* may be expedited by detaching fragments of three- to four-day-old cultures in sugar bouillon and allowing them to dry above the level of the medium at a temperature of 24° or 37° C. Forty-eight hours later the hyaline, spherical or oval asci begin to develop, and on transferring the cultures to a slightly lower temperature the yellow pigment is formed a few days later. In order to obtain comparable results with *Achorion schoenleini* the process of desiccation should be conducted on slightly older cultures giving evidence of pleomorphism.

SABOURAUD (R.) & NEGRONI (P.). **Aleuries et rudiments de fuseaux obtenus sur la culture d'Achorion schoenleinii.** [Aleuria and rudiments of spindles obtained in a culture of *Achorion schoenleini*.]—*Ann. de Dermatol.*, Sér. VI, x, 3, pp. 232–235, 5 figs., 1929.

The discovery of aleuria and rudimentary spindles with and without septa in honey agar cultures of *Achorion schoenleini*, isolated from an infant, is considered to invalidate the differentiation of the dermatophytes into two groups characterized by the presence or absence of these organs.

COTTON (A. D.). **A fungous disease of Meconopsis.**—*Gard. Chron.*, lxxxv, 2200, pp. 143–144, 1929.

The blue poppy (*Meconopsis betonicifolia* forma *baileyi*) was severely attacked in various parts of England, Scotland, and Ireland during 1928 by downy mildew (*Peronospora arborescens*) [cf. *R.A.M.*, vii, p. 536], which is also believed to have occurred in north Middlesex in 1927. Other species affected to a lesser extent include *M. grandis*, *M. wallichii*, *M. superba*, *M. paniculata*, *M. prattii*, *M. latifolia*, and *M. integrifolia*.

The first symptom of the disease is the appearance of small,

blackish spots, rapidly enlarging to elongated blotches, on the leaves and petioles; the under sides of these lesions show the characteristic grey mildew, composed of the conidiophores. In damp, mild weather many infections may occur and may involve the entire plant, including the shoot and flower buds.

Other recorded hosts of *P. arborescens* include the opium poppy (*Papaver somniferum*), on which the most severe outbreaks have been described [loc. cit.], *P. dubium*, *P. argemone*, and *M. cambrica*. Whether physiological strains of the fungus exist and if the blue poppy is susceptible to infection from other related species are not known. While it is possible that *P. arborescens* was imported into the United Kingdom from the east by means of resting spores mixed with seeds, the writer inclines to the view that the newly introduced blue poppies have become infected from other Papaveraceae already present in the gardens, either by means of air-borne conidia or through resting spores in the soil. Presumptive evidence was obtained in one case that infection had come from *M. cambrica*.

Control measures should include the isolation of *Meconopsis* from all related plants which might possibly transmit infection; the choice of fresh sites for blue poppy beds; the destruction of infected material, old plants, and refuse; and possibly the application to the foliage of a liquid copper fungicide.

VOGLINO (P.). **Il cancro o seccume pedale della Centaurea.** [Canker or desiccation of the foot of *Centaurea*.]—*La Difesa delle Piante*, Torino, vi, 2, pp. 1–5, 2 figs., 1929.

This is a brief account of a serious disease of *Centaurea imperialis* in a commercial garden of Turin, caused by a fungus which was identified as *Phoma centaureae* Boyer and Jacz., this being, as far as the author is aware, the first record of the organism on cultivated *Centaureae*. The main symptom of the disease was the development at the base of the stems and on the collar of the plants, weakened by previous attacks of mildew (*Bremia lactucae*), of large, brownish, canker-like lesions, which eventually led to the desiccation and death of the whole plant. Inoculation experiments proved the fungus to be able to attack adult specimens of *C. imperialis*, but not vigorously growing seedlings. *C. moschata* growing in close proximity to infected *C. imperialis* remained healthy, and inoculations gave negative results on this species. An emended Latin diagnosis of *P. centaureae* is appended.

There is some evidence that the disease may be effectively controlled by repeated sprayings with a 1 per cent. solution of copper oxychloride, provided the stems are well wetted with the fungicide down to their base.

OGILVIE (L.) & GUTERMAN (C. E. F.). **A mosaic disease of the Easter Lily.**—*Phytopath.*, xix, 3, pp. 311–315, 1 pl., 1929.

The symptoms of a virus disease of Easter lilies (*Lilium longiflorum* var. *eximium*), which has been under observation for some years in Bermuda and which is distinct from yellow flat [*R.A.M.*, viii, p. 383], are described. It may assume any one of the three following forms. A. Diseased plants closely resemble those suffer-

ing from yellow flat. The leaves above the third or fourth tier curl downwards and show longitudinal chlorotic streaks about 5 mm. long, which ultimately develop into rusty necrotic areas. Affected leaves wither about two months before the normal time. The characteristic streaking sometimes occurs only on one side of the plant. The flowers are reduced in number and markedly distorted, sometimes showing chlorotic stripes and mottling. The perianth segments are puckered and tend to adhere at the tips, while the stamens either fail to develop anthers or are deformed and the pistil is much twisted. Such plants apparently produce diseased secondary shoots in all cases.

B. In this mild form of the disease the leaves develop minute, pale green or yellowish, linear spots, which dry out and give rise to necrotic areas. The leaves may be twisted but the flowers are not markedly distorted.

C. This form is less common than the other two, being apparently characteristic of certain strains of Easter lily. The leaves have long, tapering points and show distinct mosaic-like mottling or chlorosis. In severe cases they are markedly stiff, crack when twisted, and often split or coalesce in pairs. Abortion of the flowers is very common, the flower parts remaining green and splitting.

As in yellow flat, the first few leaves to appear above ground seem normal, but subsequently the symptoms develop on the young foliage. A certain degree of masking occurs at mean shade temperatures above 70° F., the symptoms reappearing with the recurrence of colder weather. All three forms of the disease are most conspicuous in shaded situations.

The dissemination of infection occurs chiefly during the colder months of the year when the temperature is at 60° to 65°. Both in the field and in the greenhouse the disease spreads irregularly rather than in circular areas, as in yellow flat. Negative results were given by attempts to transmit this mosaic by the following insects commonly occurring in Bermuda: *Aphis gossypii*, *A. ogilviei*, *Empoasca fabae*, *Cicadula sexnotata*, and the bulb mite *Rhizoglyphus hyacinthi*, as well as by inoculation with extracted juice or by rubbing healthy plants with mosaic leaves.

Good control has been obtained by roguing and by the use of healthy plants for propagation. During 1928 the export of stock showing more than 5 per cent. mosaic was prohibited.

Kotthoff (P.) & Friedrichs (G.). **Der rote Brenner der Amaryllis.** [The 'rote Brenner' of *Amaryllis*.]—*Obst- und Gartenbauzeit.*, xviii, 3, pp. 32–33, 1929.

Hybrid *Amaryllis vittata* plants in Westphalian and Rhenish greenhouses have suffered for some years from a disease characterized by the development of reddish-brown spots on the flower scapes, especially on the margin. At a temperature of 22° C. the affected tissues soften and gradually dry up, resulting in large wounds which may cause the breaking or malformation of the scape. The red spots are present on the bulb scales, and the young leaves and buds are already infected on emergence. The disease was found to be due to a hitherto undescribed species of

Phoma, which is named *P. amaryllidis* n.sp., with pycnidia measuring 0·16 to 0·33 mm. and hyaline, elliptical spores, 5 to 6 by 3 to 3·5 μ in diameter. Infection is transmitted chiefly through the bulbs, though insects may also convey the spores from diseased to healthy plants. The incidence of infection may be minimized by lowering the temperature of the greenhouse to 20°.

HINO (I.) & KATÔ (H.). **Cicinnoboli parasitic on mildew fungi.** —*Bull. Miyazaki Coll. Agric. and Forestry*, i, pp. 91–100, 6 figs., 1929. [Japanese summary in roman script.]

In May, 1928, the writer observed that the patches of mildew on *Euonymus japonicus* caused by *Oidium euonymi-japonici* [the symptoms and life-history of which are briefly described: *R.A.M.*, vii, p. 326] were parasitized by a species of *Cicinnobolus* believed to be identical with *C. euonymi-japonici* Arcang. The invaded mildew areas change their colour from milky-white to greenish-lavender and become thicker and softer. The pycnidia of the parasite measure 37·4 to 67·7 by 20 to 35·5 μ, the oblong or ovoid, rarely fusiform, curved, or irregular conidia 5·2 to 10·3 by 2·6 to 3·9 μ, and the hyaline, septate hyphae 2·6 μ in width. The mildew fungus was severely injured and in some cases destroyed by its parasite.

Aster tataricus was attacked in the spring of 1928 by a mildew characterized by septate, hyaline hyphae, 7·6 to 10·3 μ wide, conidiophores measuring 69·7 to 218·8 by 9 to 12·4 μ, and elliptical or cylindrical, unicellular, hyaline conidia, 26·6 to 44·4 by 15·5 to 22·2 μ. Artificial inoculation experiments with this fungus gave positive results (after much difficulty) on *Asteromoea indica*, the conidia from the resulting lesions measuring 26·7 to 38·9 by 13·3 to 17·8 μ. The aster mildew resembles *O. chrysanthemi* [*Erysiphe cichoracearum*] but differs from the latter in its host range. It may be identical with *E. asterum* Schw., the description of which, however, is too vague to be of value. The writers therefore suggest the name of *O. astericolum* n. sp. for the mildew. The mycelium of this fungus was also parasitized by a *Cicinnobolus* with brown pycnidia, 33·3 to 62·2 by 22·2 to 38·9 μ, formed in the centre of the conidiophores, and conidia measuring 3·8 to 5·7 by 2·1 to 3·1 μ. As in the *Euonymus* mildew, the aster fungus is rapidly killed by its parasite, which differs from *C. euonymi-japonici* in the mode of pycnidial formation and in the smaller dimensions of its conidia, and from *C. cesatii* in morphological characters and host range. It is, therefore, named *C. asteris* n. sp.

YOUNG (P. A.), JELLISON (W. L.), & MORRIS (H. E.). **Plasmopara mildew of Sunflower.**—*Science*, N.S., lxix, 1783, p. 254, 1929.

Mammoth Russian sunflowers at Bozeman, Montana, were extensively attacked by downy mildew (*Plasmopara halstedii*) in 1927 [*R.A.M.*, vii, p. 243]. The disease was found on 6 per cent. of the stems, and in one row up to 26 per cent. of the plants were affected. Many of the cotyledons and leaves were conspicuously mottled in a manner suggestive of mosaic. The hyphae of the fungus were detected in sections of the cotyledons, roots, stems, and leaves. Many of the seedlings showed distinct symptoms of

downy mildew in their cotyledons and leaves within a week after emergence. Severely infected plants lived only a few weeks, and the survivors produced no viable seed. Nine out of 633 White Beauty sunflowers grown in infected soil in 1928 contracted the disease within 18 to 40 days after planting. No signs of infection appeared in 218 control plants grown simultaneously in greenhouse potting soil, or in plants raised from 858 White Beauty and Mammoth Russian seeds in autoclaved soil. It is inferred, therefore, that the plants grown in diseased soil were infected by zoospores produced by oospores overwintering in sunflower refuse.

KUSANO (S.). **Observations on Olpidium trifolii Schroet.**—*Journ. Coll. of Agric., Imper. Univ. Tokyo*, x, 2, pp. 83–99, 7 figs., 1929.

Olpidium trifolii produces small pockets on the leaf blades and irregular protuberances on the petioles and axes of the inflorescences of *Trifolium repens* in the neighbourhood of Tokyo and other parts of northern Japan. *T. pratense*, growing intermingled with *T. repens*, remains unaffected, indicating that the fungus originally described by Passerini on the former host as *Synchytrium trifolii* is a distinct organism and not identical with *O. trifolii* as some authors have suggested.

The fungus is restricted to single epidermal cells and each infected cell undergoes enlargement and deformation, these processes being most conspicuous in young tissues. In the older tissues the host cell governs the shape and dimensions of the gametangia, which may be single or up to 20 in a single cell and are elongated cylindrical or polygonal as a result of compression. The gametangium discharges by one or more (up to 12) beaks, which penetrate the wall to open at the surface. Both the hyaline epidermis and the greenish subepidermal tissue of the petiole proved equally susceptible to infection by the fungus in artificial inoculations. Resting spores, usually spherical, occur singly or in groups in infected cells, sometimes associated with gametangia. The zygote is formed as a result of copulation of the planogametes as in *O. viciae*, the actual process being figured and described. Fusion was not seen except when the gametes came from different gametangia.

Apparently the only morphological difference between *O. trifolii* and *O. viciae* is in the dimensions of the gametes and zygotes, which measure, respectively, 3·6 to 3·8 and 4·6 to 5 μ in the former, and 4 to 4·5 and 5 to 6 μ in the latter species. However, cross-inoculation experiments with *O. trifolii* on *Vicia unijuga* and with *O. viciae* on *T. repens* consistently gave negative results, indicating that these two species of *Olpidium* are distinct.

JOËSSEL (P. H.). **Quelques considérations sur les traitements des arbres fruitiers dans la basse vallée du Rhône.** [Some considerations on the treatment of fruit trees in the lower valley of the Rhone.]—*Rev. Path. Vég. et Ent. Agric.*, xvi, 2, pp. 71–88, 1929.

Notes are given in popular terms on the control of various

fungous and insect pests of fruit trees in the lower valley of the Rhone.

For blossom wilt of apricots (*Monilia* [*Sclerotinia*] *cinerea*) [*R.A.M.*, viii, pp. 180, 181] the author recommends one application of Bordeaux mixture when the flower buds open, preceded by the removal of the fruits and twigs affected during the previous season; this should be followed by another application given shortly before the opening of the first flowers.

To control *Coryneum* of peaches [*Clasterosporium carpophilum*: loc. cit.] a similar application should be made as soon as possible after the leaves have fallen; this will also serve to protect the less susceptible varieties against leaf curl [*Taphrina deformans*: ibid., vi, p. 171]. Varieties more liable to the latter should be given a further application towards the end of the winter.

Apple and pear trees should be given a protective treatment in winter for general hygienic purposes, alternating either copper sulphate mixtures with mineral oils, or lime-sulphur with lysol or carbolineum, and should be sprayed with the first-named before and after flowering to prevent scab [*Venturia inaequalis* and *V. pirina*, respectively].

LUDWIGS (K.). **Kupferkalk- oder Schwefelkalkbrühe?** [Bordeaux or lime-sulphur mixture?]—*Obst- und Gemüsebau*, lxxv, 4, pp. 61–63, 1929.

This is a general discussion in popular terms on the respective merits of Bordeaux mixture and lime-sulphur for the control of fungous diseases of fruit.

JONES (D. H.). **The fireblight situation in Ontario.**—*Scient. Agric.*, ix, 7, pp. 458–462, 1929.

In pointing out the very slight incidence in 1928 of fireblight [*Bacillus amylovorus*: *R.A.M.*, viii, p. 386] on apples, pears, and quinces around Guelph and in the Grimsby, Vineland, and St. Catharines fruit districts in Ontario, as compared with previous years, the author considers that this reduction is mainly due to the fact that during the past few years strict measures have been taken to remove and burn all diseased material. Further, the hold-over blight cankers from 1927 were not sufficiently active in the early season of 1928 to produce much gummy exudate which would cause primary infections on blossom clusters and terminals by rain or insect agency. This scarcity of the disease is believed to afford an excellent opportunity to the fruit growers to stamp out fireblight, by making a close scrutiny of their trees and drastically pruning out all infected parts.

McCOWN (M.). **Bordeaux spray in the control of fireblight of Apple.**—*Phytopath.*, xix, 3, pp. 285–293, 1929.

The results [which are tabulated and discussed] of tests carried out at Lafayette, Indiana, showed that a weak Bordeaux spray (1–3–50), applied in the full bloom period (28th April), reduced the incidence of fireblight (*Bacillus amylovorus*) from 87 in the controls to 8 per cent. in apple blossom inoculated immediately after spraying. When the blossom was inoculated 24 hours after spray-

ing there was 71 per cent. infection in the treated blossoms and 96 per cent. in the controls. The corresponding figures for inoculation 48 hours after spraying were 75 and 88 per cent. infection, respectively.

Bordeaux mixture (1–3–50) applied when the blossom clusters were opening reduced natural infection by 79 and 52 per cent., respectively, in two tests on Jonathan apples, and by 98 per cent. in one on pears.

In a series of laboratory tests, alkaline Bordeaux mixture in strengths ranging from 1/4–3/4–50 to 1/64–3/64–50 killed the bacteria after short exposures (6 to 24 minutes). A weak lime water (½ lb. hydrated lime to 50 galls. water) also killed the bacteria, but its action was less rapid than that of the Bordeaux mixture (45 to 50 minutes).

When drops of a bacterial suspension were placed on Bordeaux films (1/16–3/16–50 and 1/4–3/4–50) dried on slides, the organisms were killed immediately. The bacteria were also destroyed after varying exposures to the following preparations: Bordeaux dust (11 per cent. metallic copper), 40 minutes; colloidal copper-lime dust (15 per cent. metallic copper), 20 minutes; Holland's basic copper sulphate [*R.A.M.*, viii, p. 219], diluted with an equal amount of hydrated lime, 40 minutes; Kiltone dust (8 per cent. metallic copper), 40 minutes; and copper-lime dusts, containing 20, 25, and 27 per cent. dehydrated copper sulphate, 40 to 60 minutes.

Thomas (H. E.) & Mills (W. D.). **Three rust diseases of the Apple.**—*Cornell Agric. Exper. Stat. Mem.* 123, 21 pp., 2 pl., 3 graphs, 1929.

This is an expanded account of the writers' investigations on the rusts of cultivated apples in the Hudson River Valley of New York caused by *Gymnosporangium juniperi-virginianae*, *G. globosum*, and *G. germinale*, a preliminary note on which has already been published [*R.A.M.*, viii, p. 387]. These three rusts are termed the 'apple rust', the 'hawthorn rust', and the 'quince rust', respectively. Both the quince and the apple rust cause direct and serious losses by infection of apple fruit, while hawthorn rust is occasionally destructive on apple foliage. All three fungi are generally distributed on the red cedar (*Juniperus virginiana*) in the teleutospore stage, and *G. globosum* and *G. germinale* are perennial on this host. The last-named is more evenly and abundantly distributed throughout the cedar areas than the other two species, which are apt to be localized near apple or hawthorn trees. *G. germinale* may also occur on the common juniper (*J. communis*), which is not, however, ordinarily associated with fruit trees in eastern New York. Previous to 1924, apple rust was reported from Nova Scotia as caused by *G. juniperi-virginianae*, but later a careful survey established the fact that the disease there is due to *G. germinale*, the alternate host of which is *J. communis* var. *canadensis*, a very prevalent plant in waste pastures and rocky slopes in the Annapolis Valley.

Quince rust has never been found on apple foliage and no hawthorn rust has been seen on apple fruit. Apple leaves are attacked only by the apple and hawthorn rusts, the latter producing, on the

average, distinctly smaller lesions and relatively few aecidia. The quince rust on apple fruit presents a wide range of symptoms, which on different varieties may be very dissimilar. The lesions caused by this fungus are not exclusively restricted to the calyx end of the fruit, as in the case of apple rust, and often several separate infections are found on a single fruit.

The terminal peridial cells of apple and hawthorn rusts, mounted in water, furnish an easy means of differentiation. The terminal cells of *G. juniperi-virginianae* are relatively long and narrow, much curved, and separate readily in water, while those of *G. globosum* are irregularly lanceolate, slightly or not at all curved, and adhere in a pseudoparenchymatous plate. The peridial cells of *G. germinale* are distinctly verrucose in face view in contrast with those of *G. globosum*, which are comparatively smooth at the centre and rugose at the margins.

The aecidiospores of *G. juniperi-virginianae* and *G. germinale* germinated well after several weeks' exposure to low temperatures (3° C.).

Inoculation experiments were carried out with the three rusts on McIntosh and Wealthy foliage. No infection was obtained with *G. germinale*, but *G. juniperi-virginianae* readily penetrated the leaves of both varieties [ibid., viii, p. 428]; in McIntosh, however, the development of the fungus was usually arrested before pycnidial formation. The McIntosh variety was readily infected by *G. globosum*, which only penetrated Wealthy with difficulty.

Where practicable, the eradication of red cedars offers the best means of control of these rusts, but where this is not feasible, four applications of lime-sulphur may be recommended as a preventive of fruit infection.

McCubbin (W. A.). **Apple rust and its control.**—*Pennsylvania Dept. of Agric. Bull.*, xii, 3, 9 pp., 6 figs. (2 on cover), 1929.

Apple rust [*Gymnosporangium juniperi-virginianae*: see preceding abstract] spots disfigure the fruit and render it susceptible to rots, besides preventing the ripening of the underlying and surrounding tissues. The fungus dies out on the apple every summer after producing a crop of spores to reinfect the neighbouring red cedars (*Juniperus virginiana*) from which alone the new apple infections come in the following spring. The most promising means of control are the destruction of the alternate host within a minimum distance of half a mile from the orchards (a mile is safer) and the cultivation of resistant varieties, e.g., Stayman Winesap, Maiden Blush, and Yellow Transparent in place of the susceptible Wealthy, Jonathan, Rome Beauty, Ben Davis, and others. In south-eastern Pennsylvania spraying has proved of doubtful value, largely owing to the difficulty of predicting the exact period of infection, and to the rapid growth of the foliage, necessitating a number of successive applications which greatly increase the cost of the treatment.

Jørstad (I.). **Bekjempelse av Paereskurv.** [Control of Pear scab.]—Reprinted from *Norsk Havetid., 1929*, 4, 5 pp., 1929.

The results of the author's spraying experiments against pear

scab [*Venturia pirina*] at Ryfylke and Hardanger (Norway) in 1928 are tabulated and discussed. As in previous tests, Bordeaux mixture proved superior to lime-sulphur in the control of this disease [*R.A.M.*, v, p. 434]. At least two applications should be given, one either before the blossom or when the fruit is beginning to form, and the other immediately after petal fall. It is not yet clear whether the so-called 'white' mixture (containing a double quantity of lime in proportion to copper sulphate) is preferable to the ordinary neutral Bordeaux mixture, or if the fruit spray should be applied at a strength of 0·5 or 1 per cent.

HOCKEY (J. F.). **Currant rust control.**—*Scient. Agric.*, ix, 7, pp. 455–457, 1929.

Brief details are given of experiments which were carried out in Nova Scotia on the control of the currant rust (*Cronartium ribicola*) [*R.A.M.*, viii, p. 354] on black currants. The results showed that defoliation of this host may be prevented by four applications of sulphur dust, care being taken that the fungicide should reach the under side of the leaves. Lime-sulphur spray did not give as satisfactory control of the rust. Traces of the rust were, however, still present on the treated bushes and it is doubtful, therefore, whether such treatment of the black currants would afford sufficient protection to white pines against blister rust in districts where these trees are grown.

HANSEN (H. N.). **Thrips as carriers of Fig-decaying organisms.** —*Science*, N.S., lxix, 1787, pp. 356–357, 1929.

The general consensus of opinion with regard to the etiology of endosepsis of figs, caused by *Fusarium moniliforme* [var.] *fici* [*R.A.M.*, viii, p. 257], is that no insects enter green, hard figs unless caprification is practised. In May, 1928, the writer collected several thousand uncaprified, hard, green figs of the Calimyrna, Adriatic, Kadota, and Mission varieties from various parts of California. On microscopic examination over 20 per cent. of the figs were found to be infested by *Thrips tabaci* and *Frankliniella* sp. (probably *F. californica*). The interiors of 200 figs showing evidence of insect invasion, and of 10 apparently healthy ones, were cultured on nutrient media to determine their fungous flora. Each of the infested fruits yielded one or more of the following organisms: various species of bacteria, *Rhizopus*, *Aspergillus*, *Penicillium*, *Fusarium*, *Verticillium*, *Spicaria*, *Hormodendrum*, and a number of yeasts, while the ten sound ones remained sterile.

These data show that green, hard figs entered by thrips become inoculated with organisms capable of producing decay and fermentation in the ripening fruit. The comparatively high percentage of green, hard figs infested with thrips would appear to indicate that infection from this source alone suffices to cause heavy loss. Possibly, also, the early inception of decay and fermentation in the infested fruit, giving rise to odours attracting *Carpophilus hemipterus* [ibid., iv, p. 619] and *Drosophila ampelophila*, is partly responsible for the appearance of these insects in the orchards at the time when the figs are approaching maturity.

Bunchy top.—*Fruit World of Australasia*, xxx, 3, p. 114, 1929.

New Australian regulations for the control of bunchy top of bananas [*R.A.M.*, viii, p. 512] are stated to include the following. In quarantined areas the land must be kept free from weeds for not less than six feet from each banana plant. Where this has not been done for six months the grower must treat the bananas by spraying with an insecticide or pouring not less than 2 fluid oz. of kerosene down the stem, and then destroy the plants.

Demaree (J. B.) & Cole (J. R.). **Behavior of Cladosporium effusum (Wint.) Demaree on some varieties of Pecan.**—*Journ. Agric. Res.*, xxxviii, 6, pp. 363–370, 1929.

The investigation reported in this paper was undertaken following observations of the erratic spread on different varieties of pecan (*Hicoria* [*Carya*] *pecan*) of the scab organism (*Cladosporium effusum*) [*R.A.M.*, viii, p. 114], which suggested the existence of distinct physiological strains of the parasite. It was noted, in particular, that a variety known to be susceptible was often free from the disease when grown in close proximity to other, severely infected varieties, and that some varieties very susceptible in one locality were apparently immune in others. While the general trend in the progress of the disease seems to have been northward from the more humid region of the southern pecan belt, this has not occurred equally on all varieties.

The results of inoculation experiments [details of which are given], in which young leaves of four varieties of pecan, known to be highly susceptible, were inoculated with conidia of the fungus, showed that heavy infection resulted in all cases when the inoculation was made on the variety from which the conidia originated; when the same conidia were applied to the other species, infection was either slight or did not occur. These results are interpreted as indicating not only some physiological specialization of the fungus, but also that there is either a mixture of forms of the parasite on similar host varieties, or a plasticity in the adaptability of the forms.

Davies (R.). **Fruit storage investigations. I. Storage investigations of Pineapples in South Africa.**—*South Africa Dept. of Agric. Sci. Bull.* 71, 27 pp., 15 pl. (1 col.), 1 diag., 5 graphs, 1928. [Received June, 1929.]

Pineapples are exported from South Africa with deciduous fruits from January to April in chambers maintained at temperatures of 34° to 38° F., and with citrus from May to October at 38° to 40°. The pineapple crop in South Africa is estimated at about 20,000,000 plants.

Details are given of a series of experiments conducted to determine the best mode of pineapple storage. The fruit was stored at the Low Temperature Research Laboratory, Capetown, in small chambers cooled by side-grids with automatic control of brine flow to maintain the required temperature. The storage period was limited to between 21 and 33 days, to correspond with the ordinary period of transport. It was found that low storage temperatures (32° to 35°) resulted in the rapid and complete deterioration of the

fruit after removal from the store. Pineapples stored at 40° also showed signs of disorganization, though less pronounced than in the foregoing case, but fruit kept at 45° ripened better than at ordinary air temperature and developed an excellent colour. Similar, but ultimately slightly less satisfactory, results were obtained at 50°. The exudation of juice which takes place after storage at 32° to 40° was found to expedite the development of superficial moulds.

The results of these investigations show that pineapples cannot satisfactorily be kept in storage at temperatures below 45°, the ill-success that has attended attempts to develop the export trade in this fruit being attributed to failure to recognize this fact.

Black spot is stated to be the only important field disease of pineapples in South Africa. The flesh of fully developed fruit shows brown or black areas which are seldom apparent on the surface. The diseased areas are always situated below the floral cavity of a fruitlet and may extend to the core. Miss Bottomley states (in a private communication) that black spot may be caused by several species or strains of *Penicillium*, of which one is more virulent than the rest. Infection occurs during or just after flowering.

Soft rot, associated with species of *Penicillium* and *Saccharomyces*, occurs in fruit stored at 45° and 50°. This disease has not previously been recorded on South African pineapples, as the above-mentioned temperatures have not yet been used for commercial transportation. The organisms (of which the yeasts are more virulent than the moulds) gain entrance through bruises and rapidly penetrate the tissues.

Some general observations are made on the history of pineapple cultivation in South Africa and other points of interest, while analytical data are given in connexion with a study of the physiological changes in stored fruit.

SUNDQUIST (R.). **Installation of stationary spray plants.**—*Better Fruit*, xxiii, 9, pp. 5–8, 2 figs., 3 diags., 1929.

The use of stationary plants with spray guns for the spraying of orchards [cf. *R.A.M.*, vii, p. 42] has become general in the Pacific North-West during the past five years. The centralized spray plant with lines running through the orchard was first used in the Sacramento valley, but the system was mainly developed in the apple-growing districts in the Pacific North-West. The Wenatchee and Yakima valleys, Washington, first established the benefits of the centralized system of spraying, and there are now hundreds of such plants on orchards of from 3 to 300 acres.

The advantages of the stationary system are that it saves time and labour, since two men working two guns are kept occupied for 90 per cent. of the time, and in many instances an orchard can be sprayed in from one-half to two-thirds of the time required for portable spraying, the work also being more thoroughly effected. It eliminates compacting the ground by hauling heavy machinery over it, it avoids damage caused by knocking the machinery against the trees, and permits the spraying of closely planted orchards.

Also, when applying unpleasant sprays, the nozzle men can be widely separated.

Most of the outfits recently installed are of the 'dead end' type, i. e., each main and lateral pipe leads to a definite part of the orchard and ends there, drainage being arranged, but no return provided; the pressure regulator is situated at the pump.

Both the 'square' and 'long' systems of spraying are used. In the former the trees in each block form a series of successive squares, with a lateral pipe line running down through the middle of the squares and having a hydrant in the centre of each. The operator sprays each square, proceeding along one lateral pipe line, and then moves to another lateral and follows that. In the long system, which has recently become very popular, a long narrow rectangular block of trees (two rows wide) is laid out, its length crossing the lines of pipe. The nozzle man starts at a hydrant at one end of this block and sprays all the trees in the part of the rectangle reachable from that hydrant. He then puts the nozzle down, moves the fixed end of the hose to the hydrant on the next pipe line along the rectangle, returns to the nozzle and proceeds through the trees in the rectangle reachable from the second hydrant. The chief advantages of this system are that it requires less dragging of the free length of the hose and leaves little chance of unintentionally omitting a tree.

With the early spray systems as much as 125 or 150 ft. of free hose were used to each block of trees, but such long lines are unnecessary and uneconomical. The reduction in pipe costs is made up for by increased hose costs, which are paid for many times in the life of a system. Such lengths also reduce the efficiency of the nozzle man, as the hose is dragged slowly, and this is a fatiguing process.

The size of the pumps ranges from 12 galls. with one operator on tracts of less than 10 acres, to 50 galls. with 4 or 6 operators on tracts up to 150 acres. The loss in pressure per 100 ft. of $\frac{3}{4}$ in. pipe equals 1 lb. for each gallon of fluid discharged by the gun [cf. ibid., vi, p. 304]. The size of the main lines and laterals ranges from $\frac{3}{4}$ in. with one gun to $1\frac{1}{4}$ and $\frac{3}{4}$ in., respectively, with 4 guns, in which case the sub-main is 1 in. in diameter. Most of the pipes are laid by ploughing a furrow and then deepening this with a shovel. When tractors are available they can be used for laying the pipes by a method which is described in detail.

WEDEKIND (E.) & BRUCH (E.). **Versuche über die Wirkung von kolloidalem Calciumfluorid und Mercurochlorid auf Aspergillus niger.** [Experiments on the action of colloidal calcium fluoride and mercurous chloride on *Aspergillus niger*.]—*Biochem. Zeitschr.*, ccviii, 4–6, pp. 279–284, 1929.

The results of preliminary experiments showed that colloidal solutions of calcium fluoride and mercurous chloride exert a toxic action on *Aspergillus niger*, the latter being particularly efficacious and inhibiting all traces of growth at a concentration of 0·002 per cent. Calcium fluoride was found to be slightly less effective than sodium fluoride. The action of a solution of calcium fluoride and

mercurous chloride in the ratio of 1 : 1 was identical with that of mercurous chloride alone. The toxicity of these substances was found to be due primarily to the ions.

WOLLENWEBER (H. W.). **Chinosol gegen schädliche Pilze.** [Chinosol against injurious fungi.]—*Angew. Bot.*, xi, 2, pp. 116–120, 1929.

The fungicidal efficacy of chinosol [*R.A.M.*, iv, p. 188] was tested against 14 parasitic fungi. The growth of *Botrytis cinerea*, isolated from decayed dahlia roots, was inhibited at a concentration of 0·0025 per cent., at which strength also *Gloeosporium fructigenum* from rotting fruit, *Graphium ulmi* from elms affected by die-back [ibid., viii, p. 343], *Calonectria graminicola* from rye, and *Gibberella saubinetii* from wheat failed to develop. The growth of *Fusarium lini*, the causal organism of flax wilt, was inhibited at a concentration of 0·03 per cent.

KOSTOFF (D.). **Studies on callus tissue.**—*Amer. Journ. of Botany*, xv, 10, pp. 565–576, 5 pl., 1 diag., 1928.

A macroscopic and microscopic examination of the callus of intergeneric and interspecific whip grafts between various Solanaceae [which are enumerated: *R.A.M.*, viii, p. 327] showed that the callus tissues joining the scion and the stock are derived mainly from the latter. Large accumulations of starch occur at the base of the scion just above the callus line. This excessive supply of food gives rise to the formation, by the scions of certain unions, e.g., *Nicotiana rustica* on *Datura ferox*, *N. langsdorffii* on *Solanum nigrum*, *N. sanderae* on *D. wrightii*, *S. nigrum* on *D. ferox*, *S. nigrum* on tobacco, *Lycium barbarum* on tomato, &c., of various types of proliferation, some of which develop into tumours, and others give rise to aerial roots or leafy shoots. Superficially these tumour-like formations and adventitious roots and shoots resemble those found in crown gall (*Bacterium tumefaciens*) [ibid., i, p. 164].

Abnormal vascular strands and cells, singly or in groups, were often found in the joining tissues both in the pith region and in the proliferations. Where the tissue of one component of the graft is pigmented, the pigment is limited by the callus, and no effect is observed in the other component. The proliferations in the callus, its asymmetry, and other phenomena observed, are interpreted as being due to the specificity and interactivity of the graft components.

LIKHITÉ (V.). **Cytological aspects of the virus diseases in plants.**—*Meded. Landbouwhoogeschool te Wageningen*, xxxiii, 2, 12 pp., 1929. [Dutch summary.]

In this paper the writer briefly recapitulates the results of his own researches, and those of other workers, on the nature of the cell inclusions associated with virus diseases of plants. Most of the papers cited in the bibliography of 57 titles have been noticed in this *Review*.

BLATTNÝ (C.). **Mosaika Konvalinky (Convallaria majalis L.).** [The mosaic of the Lily of the valley (*Convallaria majalis* L.).] —*Ochrana Rostlin*, ix, 1, pp. 19–21, 1 fig., 1929.

The author states that in 1926 he observed that many plants of the lily of the valley (*Convallaria majalis*) growing wild in several localities of the Bohemian highlands were affected with typical mosaic, the symptoms of which are briefly described. The infectious nature of the disease was proved by successful inoculation of the underground parts of healthy plants with juice from infected specimens and by cutting the plants with a contaminated knife. This discovery is important, since the lily of the valley has of late been cultivated on a commercial scale in Czecho-Slovakia. Transmission of the mosaic in glasshouses may, perhaps, be effected by insects, e.g., the white fly (*Aleurodes vaporarium*), commonly found in them.

CLEMENT (E.). **Non-symbiotic and symbiotic germination of Orchid seed.**—*Orchid Rev.*, xxxvii, 429, pp. 68–75, 10 figs., 1929.

The writer's continued researches on the germination of orchid seed by symbiotic and asymbiotic methods [*R.A.M.*, v, p. 758] indicate that the former is preferable with *Cypripedium*, *Cymbidium*, and to some extent with *Odontoglossum*. In other cases the asymbiotic method generally produces very satisfactory results [ibid., vii, pp. 387, 531], though it may sometimes be necessary to transfer seedlings grown by this process to flasks containing a prepared compost inoculated with the appropriate fungus (*Rhizoctonia repens*) for a period of four to five months in order to accelerate their development.

CATONI (G.). **La fruttificazione basidiofora di un endofita delle Orchidee.** [Basidiophoral fructification of an endophyte of Orchidaceae.]—*Boll. R. Staz. Pat. Veg.*, N.S., ix, 1, pp. 66–74, 13 figs., 1929.

The hyphae of a culture of the endophyte of a species of *Cypripedium*, which had been used to germinate *Cymbidium* seedlings [see preceding abstract], was found to show the clamp-connexions characteristic of the Basidiomycetes, and in further transfers fructifications were observed. The reproductive organs were present only in cultures contaminated by *Cladosporium herbarum*. The mycelium of the endophyte is hyaline, with a yellowish tint when older. The hyphae measure 3 to 5 μ in diameter, and show rather numerous clamp-connexions. In fully grown cultures the cells are arranged in moniliform chains, the articulations measuring 6 to 15 by 4 to 10 μ. The fructifications are borne on a dense, white, felted superficial layer, chiefly on irregular protrusions on its surface. The clavate basidia are arranged in a loose hymenium and measure 12 to 20 by 3 to 6 μ. Cystidia of variable shape (generally subfusoid) are also found. The sterigmata, which number 3 to 6, are 3 to 5 μ long. The white, transparent, reniform, uniguttulate spores measure 4 to 5 by 3 μ. The fungus probably belongs to the genus *Hypochnus*, but the species was not

determined. Reference is made to previous investigations by other workers as tending to show that the endophyte of the Orchidaceae is a *Rhizoctonia* allied to *R. solani* (the perfect stage of which is known to be *Hypochnus* [*Corticium*] *solani*), and the author's discovery is considered to demonstrate the correctness of this view, while leaving the exact identity of the fungus to be decided by further work.

RAYNER (Miss M. C.). **The multiple mycorrhizas of trees.**—*Forestry*, iii, 1, pp. 26–32, 1929.

In this note the author briefly summarizes recent work on the nature and functions of mycorrhiza in forest trees, with particular reference to that done by Masui in Japan [*R.A.M.*, vi, pp. 306, 307] and Melin in Europe [ibid., vi, p. 681], and is inclined to accept the latter's theoretical conclusions on the subject, since observations in the field tend to support them. At the same time she points out the practical developments which may ensue from this study from the point of view of a proper control of the soil conditions which favour or depress the free development of the right kind of mycorrhizal fungi, a question which is of considerable importance to practical silviculture, e.g., to the afforestation of new areas.

BOTHE (F.). **Über den Einfluss des Substrats und einiger anderer Faktoren auf Leuchten und Wachstum von Mycelium x und Agaricus melleus.** [On the influence of the substratum and certain other factors on the luminosity and growth of *Mycelium x* and *Agaricus melleus*.]—*Sitzungsber. Akad. Wissensch. Wien*, Ab. I, cxxxvii, 8, pp. 595–626, 5 graphs, 1928.

Full particulars are given of the technique and results of the author's investigations on the effect of various factors on the luminosity and growth of *Mycelium x* (supplied by Prof. H. Molisch) and *Agaricus melleus* [*Armillaria mellea*: *R.A.M.*, vi, p. 586].

It was found that alkali chlorides and sulphates, at concentrations of 0·5 to 1 per cent., greatly stimulated luminosity, the effect of K being more marked than that of Na. Alkali nitrate also promoted luminosity at a concentration of 2 per cent., while the ammonium salts tended to suppress this phenomenon, especially in *A. mellea*. A marked access of luminosity, both in *A. mellea* and *M. x*, followed the addition to the cultures of zinc (0·001, 0·0001, and 0·00001 per cent.). No recrudescence of luminosity was induced by the admixture of living cultures of other fungi or bacteria, whereas the addition of dead fungous material, e.g., of *Psalliota campestris*, to cultures of *M. x* resulted in a great increase of luminosity.

The substitution of glycerine or fructose for the 5 per cent. cane sugar solution in the standard agar medium proved beneficial both as regards luminosity and growth. Bread, plum decoction, and potato were the best media for the growth of both organisms.

Wounding the mycelium of *M. x* resulted in a stimulation or recrudescence of luminosity according to the age of the cultures, the

phenomenon beginning in ten minutes, culminating in five to eight hours, and declining after three days.

The optimum temperature for luminescence was found to be about 16° C., though the inception of the process was stimulated in *M. x* by a temperature of 24° and in *A. mellea* by 18° to 20°. At 31° to 34° there was a noticeable decline of luminosity. The brown coloration of the mycelium of *A. mellea* was found to depend solely on the presence of oxygen; where this was excluded, e. g., between the cortex and the wood of spruce roots, the fungus remained white. The development of rhizomorphs by *A. mellea* appears to depend on the nutrient content of the substratum and the permeability of the latter for oxygen.

MACHACEK (J. E.). **Studies on the association of certain phytopathogens.**—*Twentieth Ann. Rept. Quebec Soc. Protect. Plants, 1927–1928*, pp. 16–63, 14 diags., 1928. [Received June, 1929.]

An experimental study [full details of the technique and results of which are given] was conducted on the association, in nature and in culture, of various plant pathogens responsible for rots of stored fruits and vegetables and of greenhouse tomatoes [cf. *R.A.M.*, iii, p. 471; viii, p. 236].

Several types of association exist, viz., (1) where one organism predominates to such an extent as almost to preclude the growth of others, e.g., in the apple rot caused by *Penicillium expansum* [ibid., viii, p. 50] when associated with *Sclerotinia fructicola* [*S. americana*]; (2) where the pathogens mix freely (*S. sclerotiorum* and *Erwinia carotovora* [*Bacillus carotovorus*] in carrot lesions); and (3) where the parasite is usually followed by a saprophyte (*Pythium* (?) *de Baryanum* succeeding *Botrytis allii* on onions or *Phycomyces* sp. developing in the wake of *S. perplexa* on cabbage).

Temperature was found to play an important part in the development or suppression of a given organism in mixed cultures or in association on the host. Thus, at 30° to 40° C. *P. expansum* made little growth, while *S. americana* grew well. Similarly, the amount of inoculum was found to influence the development of a fungus in a mixed culture, *S. americana* being completely suppressed by *P. expansum* where the spore numbers of the latter were equal to, or exceeded, those of the former. On the other hand, the weaker organism may develop to a certain extent if represented by a larger number of spores than the associated fungus. A similar relation prevails in the case of the tomato-rotting fungi, *Botrytis* sp. and *Cladosporium fulvum*, where the latter tends to predominate. The hydrogen-ion concentration was found to have no very marked influence on the association, though some of the fungi tested could grow at concentrations that inhibited a normally dominant species. When the presence of a species inhibits the growth of another, the inhibition appears to be due to some toxic agent other than acid. The toxic agent was shown to be present in the staled media in which the inhibiting organism had grown, and to be partially removed by autoclaving.

The pathogens used in these tests were found to be unable to grow in the absence of free oxygen. Spore germination was diminished by extremes of temperature and hydrogen-ion concen-

tration, as well as on staled media. The behaviour of the associations in culture and on the host was sometimes markedly different. The order in which the infections take place on the host may influence the result.

JOHNSON (J.). **The classification of certain virus diseases of the Potato.**—*Wisconsin Agric. Exper. Stat. Res. Bull.* 87, 24 pp., 6 pl., 1929.

This is an expanded account of the author's attempt to secure a satisfactory basis for the classification of certain virus diseases of the potato, a preliminary note on which has already appeared [*R.A.M.*, vii, p. 462]. The Bliss Triumph variety was mainly used, as it appears to be the most susceptible of the varieties commonly grown in America. Special attention was directed towards crinkle, rugose, leaf rolling, and mild mosaic, to the study of the spot necrosis virus in relation to rugose mosaic, and to mottle in healthy potatoes. It is pointed out that the use by Wisconsin workers of the term rugose mosaic to describe the mosaic of Bliss Triumph potatoes in Wisconsin has led to confusion, since this disease is not the rugose mosaic of Schultz and Folsom [ibid., iii, p. 548] but corresponds to their crinkle mosaic [ibid., iv, p. 692]. This last disease is quite distinct from the crinkle of Quanjer and Murphy in Europe [ibid., iii, pp. 415, 602], resembling more closely their simple or common mosaic. In the present publication the author has endeavoured to conform to the terminology of Schultz and Folsom.

The following characteristics of the viruses were investigated: longevity *in vitro*, thermal death-point, tolerance to dilution, varietal susceptibility, and expression of symptoms. As a whole, the potato viruses were found to be very sensitive to unfavourable conditions as compared with the tobacco mosaic virus [ibid., vi, p. 501]. The virulence of the former group is rapidly lost *in vitro*; they are destroyed by relatively low temperatures (40° to 45° C. for crinkle and mild mosaics, 60° to 65° for rugose, and 70° to 75° for leaf-rolling mosaic); and their tolerance to dilution is comparatively low, falling off rapidly in most cases beyond dilutions of 1 in 10 or 1 in 100. The expression of symptoms is so variable as sometimes to preclude determination on this basis even under reasonably constant environmental conditions. Evidence is further presented for the identity of true rugose mosaic with spot necrosis [ibid., v, p. 119], a condition probably occurring in an attenuated form in practically all apparently healthy potatoes of the standard varieties.

WEDGWORTH (H. H.). **Degeneration diseases of the Irish Potato in Mississippi.**—*Mississippi Agric. Exper. Stat. Bull.* 258, 11 pp., 7 figs. (1 on cover), 1928. [Received February, 1929.]

Popular notes are given on the symptoms and effects of mosaic, leaf roll, and spindle tuber of potatoes, which are stated to cause heavy damage to Mississippi crops. The results of recent investigations show the following reductions in yield from the various degeneration diseases: 1927 (average of 2 plots): healthy 89·2 bushels per acre, mild mosaic 63·6, rugose mosaic 27, spindle tuber

40·4, and leaf roll 18·7; 1928 (average of 4 plots): healthy 180·2 bushels per acre, mild mosaic 131·2, rugose mosaic 71·3, spindle tuber 79·2, and leaf roll 68·9. Attention is drawn to the necessity of using disease-free seed, of which adequate supplies are now available.

REILING (H.). **Beiträge zur Kenntnis der Viruskrankheiten der Kartoffel.** [Contributions to the knowledge of the virus diseases of the Potato.]—*Pflanzenbau*, v, 17–18, pp. 267–273; 19–20, pp. 284–290, 1 pl., 1929.

The author discusses, tabulates, and presents in a diagrammatic form the results of his four years' observations at Soltau, Hanover, on the incidence of the virus diseases, leaf roll, crinkle or curl (Kräuselkrankheit), mosaic, streak, and bouquet, in the relatively pure material of a potato seedling crop (20,000 seedlings of 65 families). In the first year the crop was grown from true seed obtained by crossing, and in the three following by vegetative methods. The data showed that crinkle (which was the principal object of the investigations) affected only a comparatively low proportion of the progeny of these crosses, and it is believed that a consistent course of timely roguing would completely eliminate this source of infection. Mosaic and leaf roll were present in a considerable number of the plants examined, but the incidence of bouquet and streak was very slight; the latter did not appear until the F_4 generation, suggesting a slow rate of spread.

PACHECO (G.). **Doença bacteriana da Batata.** [Bacterial disease of the Potato.]—*Arch. Inst. Biol. Defesa Agric. e Animal*, i, pp. 69–82, 3 pl., 1928. [English summary. Received June, 1929.]

Early in May, 1928, some potato tubers stored in a warehouse at Monte-Mor, San Paulo, Brazil, developed a soft, dark rot with a smell resembling that of salted herrings. The infected tubers contained a bacillus measuring 0·5 to 0·8 by 0·7 to 2·1 μ and resembling (except for minor differences) *Erwinia* [*Bacillus*] *melonis* and *E. solanisapra* [*B. solanisaprus*: *R.A.M.*, iii, p. 164; v, p. 408; viii, p. 397], especially the latter. According to Smith ('Bacterial Diseases of Plants', 1920) *B. solanisaprus* and *B. melonis* are identical, the former name being preferred on grounds of priority, and the Brazilian organism is accordingly referred to this species.

The pathogenicity of the bacterium was demonstrated by inoculations on tubers kept in a moist atmosphere, at a high temperature (21° C.), protected from the light. It was found that aeration, illumination, and desiccation checked the early stages of infection.

A histological study of diseased potato tubers showed that *B. solanisaprus* corroded the starch grains in the affected cells and eventually dissolved them in a zone in advance of the area occupied by the organism. As the supply of nutrition diminished *B. solanisaprus* disappeared, its place being taken by secondary organisms which dissolved the cellulose and led to the formation of cavities.

CLAYTON (E. E.). **Potato seed treatment experiments on Long Island with special reference to the organic mercury instant dips.**—*New York (Geneva) Agric. Exper. Stat. Bull.* 564, 32 pp., 3 figs., 1929.

The outcome of four years' experiments [which are fully described and the resulting data tabulated] on Long Island, New York, in the control of various potato diseases by seed treatment with organic mercury compounds, e. g., Bayer dust, Bayer dip dust, semesan bel, and semesan jr., and corrosive sublimate shows that the latter is the most effective against scab [*Actinomyces scabies*] and *Rhizoctonia* [*Corticium solani*: see above, p. 553]. However, owing to the prevalence of soil infection in the locality under observation, seed treatment against these diseases is scarcely profitable, especially as the Long Island crop is generally grown from the best certified seed, so that seed-borne infection is of little consequence. The organic mercury compounds were effective in the control of seed-piece decay (due to various secondary organisms attacking the cut surface of tubers injured by drought combined with poor mixing of chemical fertilizers and soil), but this disturbance is not sufficiently widespread to justify the general adoption of preventive measures. Moreover, the increased yield (2 per cent.) resulting from disinfection with the mercury compounds is not considered great enough to warrant their extended use under Long Island conditions.

HOPKINS (J. C. F.). **Two common diseases of Potato tubers in Rhodesia.**—*Rhodesia Agric. Journ.*, xxvi, 3, pp. 257–259, 1929.

A very brief and popular account is given of the *Rhizoctonia* [*Corticium*] *solani* scurf of potato tubers, which is stated to be of common occurrence in Rhodesia. The control measures recommended are the use of disease-free tubers for seed and, as a further precaution, their disinfection with mercuric chloride solution, brief recommendations for the preparation and use of which are given.

Probably the commonest potato tuber disease in Rhodesia is sprain or internal rust spot [*R.A.M.*, viii, p. 398], which is locally known under the names of internal browning or brown fleck. The brief outline given of the symptoms, causal organisms [*Bacterium rubefaciens* and *Bact. suberfaciens*], and control measures is entirely based on Burr's investigation of the disease [see next abstract].

BURR (S.). **Sprain or internal rust spot of Potatoes. Bacterium rubefaciens.**—*Univ. of Leeds and Yorkshire Council for Agric. Education Bull.* 160, 24 pp., 3 pl., 1 fig., 1929.

After giving a brief summary of his previous technical account of sprain or internal rust spot (*Bacterium rubefaciens*) of potato [*R.A.M.*, viii, p. 398], the author describes in some detail experiments which were made in 1925 to test the resistance to it of a number of potato varieties, and of field experiments in its control during 1926 and 1927. The results showed considerable variations in the relative susceptibility of the varieties tested, Crusader, Field Marshall, Golden Wonder, and Bishop exhibiting the lowest, and Resistant Snowdrop, Catriona, and Majestic the highest resis-

tance, as judged by the development of the trouble during storage throughout the winter. The control experiments indicated that some reduction of the disease followed heavy applications to the soil of sulphate of potash or sulphate of ammonia, but to an extent hardly justifying their use. Comparable results were also obtained with very heavy dressings of ground lime or with applications of a creslyic acid and lime mixture, while highly satisfactory control was afforded by green manuring before planting the potatoes. Some practical hints are given in regard to the best methods of green manuring.

Schorffeste und schorfanfällige Kartoffelsorten. [Scab-resistant and scab-susceptible Potato varieties.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, ix, 2, p. 15, 1929.

On the basis of extensive tests conducted by the Biological Institute during the period 1926 to 1928 on over 200 potato varieties, 20 varieties are here enumerated as resistant and 36 as susceptible to scab [*Actinomyces scabies*]. The varieties that are also immune from wart disease [*Synchytrium endobioticum*] are indicated.

SCHLUMBERGER (O.). **Schorffeste und schorfanfällige Kartoffelsorten.** [Scab-resistant and scab-susceptible Potato varieties.] —*Illus. Landw. Zeit.*, xlix, 9, pp. 99–100, 4 figs., 1929.

This is an expanded account of the recent German official tests of varietal reaction to potato scab (*Actinomyces*) [*scabies*: see preceding abstract].

Krebsfeste Kartoffelsorten. [Wart-immune Potato varieties.]—*Oesterr. Zeitschr. für Kartoffelbau, 1929*, 1, pp. 29–30, 1929.

Four new potato varieties have been recognized by the German Plant Protection Service (December, 1928) as immune from wart disease [*Synchytrium endobioticum*: *R.A.M.*, viii, p. 522], viz., Berlichigen (medium-early), Berolina (late), Gneisenau (late), and Nordost (medium-late). The first three are supplied by the Pomeranian Seed Selection Company and the last-named by Hasenberg. The total number of wart-immune varieties officially recognized by the above-mentioned service now amounts to 74.

KŘIŽ (K.). **Zkoušky Bramborových odrůd na vzdornost vůči rakovině bramborů v r. 1928.** [Trials in 1928 of Potato varieties for resistance to potato wart disease.]—*Ochrana Rostlin*, ix, 1, pp. 6–9, 1929.

The results of potato varietal trials for resistance to wart disease [*Synchytrium endobioticum*] which were made in 1928, in continuation of previous work, in the neighbourhood of Sluknov [Czecho-Slovakia], showed that most varieties of Czecho-Slovakian origin are highly resistant to, if not entirely immune from, the disease. It is pointed out, however, that resistance may vary with environmental conditions; thus, varieties apparently immune in the field have been found susceptible under experimental conditions, while

some varieties considered to be immune in other countries (e. g., Thiele in Germany) proved to be susceptible in Czecho-Slovakia. A list is given of named potato varieties whose resistance to wart disease has been proved in several years' tests and another of those that showed immunity in the 1928 trials.

LEPIK (E.). **Untersuchungen über den Biochemismus der Kartoffelfäulen. I. Der Einfluss der Phytophthora-Fäule auf die chemische Zusammensetzung der Kartoffelknolle.** [Investigations on the .biochemistry of the Potato rots. I. The influence of the *Phytophthora* rot on the chemical composition of the Potato tuber.]—*Phytopath. Zeitschr.*, i, 1, pp. 49–109, 9 figs., 6 graphs, 1929.

Extensive researches were made at Zürich during the period 1926–28 on the biochemical reaction of potato tubers to infection by *Phytophthora infestans*. The results of the author's experiments [which are tabulated and discussed at length] showed that the *Phytophthora* rot is accompanied by an increase of the pentosans, methylpentosans, and crude fibre in the tubers, and by a decrease of the dry matter. The diseased portions of the tubers were found to give an alkaline reaction instead of the normal acid one. In the later stages of the disease a superficial corrosion and gradual dissolution of the starch granules could be detected under the microscope.

The *Phytophthora* rot is characterized by the restriction of the fungus to the peripheral regions of the tuber. The hyphae are mainly confined to the intercellular spaces; they penetrate between the cells, not only by the dissolution of the middle lamellae, but also by mechanical pressure against the cell walls. Under favourable conditions the fungus can completely permeate all the external layers of the tuber as far as the vascular bundle zone in a few weeks, whereas the innermost parts are still sound three to four months after the inception of decay. The extension of *P. infestans* in the tuber does not depend on the chemical composition or water content of the latter, but on the oxygen supply; the exclusion of air inhibits the further development of the fungus. This process is not impeded, however, by the storage of diseased tubers under dry conditions.

A bibliography of seven pages is appended.

RACICOT (H. N.). **The effect of Bordeaux mixture on the yield of Potatoes during three blight-free years.**—*Twentieth Ann. Rept. Quebec Soc. Protect. Plants, 1927–1928*, pp. 64–66, 1928. [Received June, 1929.]

The results [which are tabulated] of three years' experiments (1925 to 1927) in the application of Bordeaux mixture to Green Mountain potatoes in eastern Quebec (six treatments between 30th June and 10th August) were very satisfactory. Late blight [*Phytophthora infestans*] did not appear during the period under review, but the increased yield of treated compared with untreated plants amounted to 16 bushels per acre. This is ample compensa-

tion for the cost of spraying, and insures the crops against the sudden development of the disease.

VOGLINO (P.). **Il mal dello sclerozio rosso della Barbabietola e della Patata.** [The red sclerotium disease of the Beet and the Potato.]—*La Difesa delle Piante*, Torino, vi, 1, pp. 1–8, 2 figs., 1929.

A brief account is given of a severe outbreak of *Typhula variabilis* [*R.A.M.*, vi, p. 80] on potatoes in 1928 in a low-lying, damp field, heavily fertilized with stable manure, in the neighbourhood of Savigliano [Piedmont]. The symptoms were a rapid wilting of the plants, the leaves of which became distorted, yellowish, and died in a few days; the underground parts of the stems, which could be pulled out without effort, as well as the tubers (in all stages of development), were markedly softened and covered with a light, whitish mycelial felting. When kept moist and poorly aerated, these parts were soon covered with a denser, white felt, on which rapidly developed spheroidal or oblong sclerotia, at first yellowish and later orange-red to reddish-brown, measuring from 2 to 5 mm. in diameter. In the same locality the fungus was also observed severely attacking forage beets.

A brief outline is given of the history, affinities, geographical distribution, morphology, and biology of *T. variabilis*, which was first described by Tode in 1790 under the name *Sclerotium semen*. The author states that, so far as he is aware, the potato is a new host for this fungus. A brief reference is also made to some artificial inoculation experiments, in which he succeeded, under conditions of high humidity and poor aeration, in infecting healthy beet roots, potato roots and tubers, and asparagus rhizomes with germinating sclerotia of the fungus, thus demonstrating its parasitic nature. Sclerotia from beet and asparagus gave rise to the perfect form of the fungus, consisting of a thin, soft, whitish or yellowish, cylindrico-contorted claviform stipe, covered with a fine down and up to 35 mm. high by 0·2 to 0·3 mm. broad at the base, the swollen apex 0·6 to 0·8 mm. long and furnished with basidia bearing 4 sterigmata on which developed hyaline, ellipsoidal spores, 6 to 7·8 by 2·5 to 3·5 μ in diameter.

The maintenance of the disease from year to year, and its spread, are chiefly ensured by the sclerotia, which were shown to be able to remain viable for several months on dead portions of the hosts, or, given favourable conditions, to germinate immediately after formation. The chief line of control should therefore consist in the immediate uprooting of all diseased plants and their destruction by fire on the spot, since the sclerotia are easily detachable from the substratum and may be disseminated when diseased material is removed to a distance. It is stated that in the field of beet observed near Savigliano, the disease was effectively controlled by roguing and burning the infected plants, and abundantly watering the soil under them with a 4 per cent. solution of copper sulphate. Good results may also be obtained by liming the soil in the proportion of 1 part lime to 3 parts of earth. Preventive measures should consist in good drainage of damp soils and suitable manuring with potassium phosphate.

MERKENSCHLAGER (F.). **Über das Schwarzwerden der Kartoffelknollen.** [On the black discoloration of Potato tubers.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, ix, 3, pp. 20–21, 1929.

The black or blue discoloration extensively assumed by potato tubers of the 1928 harvest on sectioning and cooking is stated to have caused much concern among German producers and consumers. This phenomenon, however, is merely due to the activity of the enzyme tyrosinase, which converts the amino-acid tyrosin into melanin. Under normal conditions the development of melanin is prevented by boiling, but occasionally, as in the year in question, the tyrosin content of the tubers is so abundant that the black discoloration appears almost immediately.

ADAMS (J. F.). **An actinomycete the cause of soil rot or pox in Sweet Potatoes.**—*Phytopath.*, xix, 3, pp. 179–190, 1 pl., 1929.

No evidence has been obtained that the pox or soil rot disease of sweet potatoes [*R.A.M.*, vii, p. 343] is due either to *Acrocystis batatas* or *Cystospora batata* as claimed by previous investigators.

A species of *Actinomyces*, herein referred to as *A. p.*, has been isolated from pox lesions and found to be pathogenic on the fleshy roots and cut slices of sweet potato, on emerging root-points and rootlets from fleshy roots as well as on the primary root, and on the rootlets and stems of sweet potato sprouts. Cytological studies showed the same organism to be present both in natural and artificial pox lesions on sweet potatoes. The organism is apparently both inter- and intracellular, being most conspicuous within the host cells.

A. p. was found to be pathogenic on wounded surfaces of white potato, beet, and turnip, but not on carrot or dahlia. The optimum temperature range for its growth was shown to be between 30° and 37° C. *A. p.* was found to differ in cultural characters from *A. scabies*, though both produced infection on cut slices and rootlets of sweet and white potatoes. *A. poolensis*, to which the disease was at one time attributed [ibid., v, p. 470], gave negative results in inoculation experiments on these hosts, and is therefore regarded as a distinct organism.

MITCHELL (J.). **Organizing Secretary's Report on visits to estates.**—*Seventh Rept. Exec. Ctte. Rubber Res. Scheme (Ceylon). Proc. during the year 1928*, pp. 9–11, 1929.

During 1928, 59 rubber estates in Ceylon were visited, and notes made on the prevalence of various diseases in them.

Fomes lignosus is well under control, and the author considers that with suitable treatment the disease can be almost completely eradicated. *F. lamaoensis* killed some old, isolated trees, but no serious outbreak was reported. *Ustulina zonata* was the most prevalent root disease, the oldest trees, apparently, being the most susceptible. If the disease is discovered when still in an early stage (to which end frequent inspection is recommended) cure is usually possible by the method of cutting out and filling the cavities [*R.A.M.*, v, p. 691].

Stripe canker or bark rot [*Phytophthora* sp.] was not found on any estate; it is considered that by combining an application of 5 per cent. brunolinum plantarium after each tapping with a further application every 10 or 14 days of cargillineum mixture almost complete protection from this disease can be secured. It is stated elsewhere (p. 24) that 1 lb. of cargillineum sufficed for about 400 trees, at a cost of about 10 cents [nearly twopence] per acre of 100 trees, and 1 gall. of brunolinum plantarium was sufficient for 3,300 trees at a cost of about 1·25 cents per acre.

Brown bast [ibid., vii, p. 468] is the most serious disease of rubber in Ceylon. Numerous estates now carry out treatment systematically and it is hoped that this will soon become a routine operation. The recovery of the bark surfaces after scraping was very satisfactory; this method, it is thought, might well be used to stimulate excessively slow bark renewal, even in the absence of brown bast.

Oidium leaf fall [*O. heveae*: ibid., viii, p. 461] has become more prevalent and severe. Experiments in control are to be carried out.

MURRAY (R. K. S.). **Mycologist's Report for 1928.**—*Seventh Rept. Exec. Ctte. Rubber Res. Scheme (Ceylon). Proc. during the year 1928*, pp. 22–25, 1929.

An examination of the entire root systems of several *Hevea* rubber saplings in Ceylon indicated that while *Rhizoctonia bataticola* [*R.A.M.*, viii, p. 406] may be parasitic on rubber roots, and ultimately kill them, it is not necessarily a precursor of *Fomes lignosus*; three complete root systems apparently killed by *F. lignosus* showed no evidence of *R. bataticola* even after exhaustive examination and cultural work.

Oidium leaf fall [*O. heveae*: see preceding abstract] was present on most estates, nearly all the severe attacks occurring at mid- and up-country elevations, where the disease is active throughout the year. At relatively high elevations the disease is annually becoming more severe, while in the low-lying districts, although it is more prevalent than formerly, it was less severe on many estates than it was in 1927. It is thought probable that alternate wet and dry periods favour infection. Hill slopes and exposed ridges are more severely attacked than flats and hollows. Several estates reported lessened injury from this disease following the use of manures.

A disease of the shoots of young budded rubber is being investigated. The shoots die back, usually from the tip down to the base. The affected part turns brown, then almost black. The pycnidia of a species of *Phoma* were found in the black portion of every diseased shoot examined, and the same fungus was invariably isolated from the margins of the discoloured areas. Inoculation with diseased material gave positive results when the stem was previously wounded, suggesting that the causal organism is a weak parasite.

An examination of angular brown spots on the leaves of *Dolichos hosei* (*Vigna oligosperma*) showed that they were attacked by a species of *Uromyces*.

O'Brien (T. E. H.). **Chemist's Report for 1928.**—*Seventh Rept. Exec. Ctte. Rubber Res. Scheme (Ceylon). Proc. during the year 1928*, pp. 12–17, 1929.

Two apparently identical samples of blanket crepe rubber were prepared in January, 1928, from one batch of latex coagulated, respectively, with acetic acid and acetic acid containing paranitrophenol in the proportion of 1 to 4,000 parts dry rubber. After twelve months' storage the rubber which was not treated with the paranitrophenol was badly mottled and showed surface mould, whereas the other was quite satisfactory.

The addition of this proportion of paranitrophenol is recommended for the manufacture of blanket crepe which is likely to be stored for some time or sold in a distant market [cf. *R.A.M.*, vi, p. 575].

Fleming (W. E.). **Effects of carbon disulfide treatment of soil for the Japanese beetle on the abundance of microorganisms and on the ammonia and nitrate content.**—*Soil Sci.*, xxvii, 2, pp. 153–158, 1929.

In connexion with a study of the effects of carbon disulphide treatment of sassafras loamy sand soil against the Japanese beetle [*Popillia japonica*], it is mentioned that the application of this compound (0·05 per cent.) at the rate of 1 lb. per cu. yd. greatly stimulated the development of *Zygorrhynchus* and *Penicillium* spp. [*R.A.M.*, iii, p. 363] which were three times as plentiful in the treated soil 112 days after treatment as all the fungi in the original soil.

Noble (R. J.). **Some observations on the relationship of soil conditions to the development of disease in plants.**—*Rept. Australasian Assoc. for the Advancement of Science, 1928*, pp. 574–580, 1929.

In connexion with some general observations on the relation between environmental (especially soil) conditions and the development of fungous diseases in plants, the author briefly cites some illustrative examples, of which the following (all occurring in New South Wales) may be mentioned: downy mildew of cereals (*Sclerospora macrospora*), powdery scab of potatoes (*Spongospora subterranea*), take-all and flag smut of wheat (*Ophiobolus graminis* and *Urocystis tritici*), and root rots of beans and tomatoes (*Fusarium* spp.).

Jaczewski (A. A.). К вопросу о распространении ложной мучнистой росы Хмеля. [On the question of the spread of downy mildew of the Hop.]—*La Défense des Plantes*, Leningrad, v, 5–6, pp. 595–599, 1929.

In giving a brief historical outline of the occurrence of downy mildew (*Pseudoperonospora humuli*) of hops in Japan, North America, and Western Europe, the author points out the extreme rapidity with which the disease has spread in Europe since 1925, when the first reports on it began to appear in the chief west European hop-growing centres. In Russia, since Naoumoff's record

of the fungus in the government of Louga [*R.A.M.*, viii, p. 335], it has been found, chiefly on wild hops, in several widely separated localities; in the Caucasus, in particular, it was observed on wild hops growing in the fastnesses of almost virgin forests, hardly penetrated by man, and far removed from any cultivated hops. During the summer of 1928, however, a systematic search revealed the disease on cultivated hops in several districts of west Russia, where it was doing very appreciable damage.

All these observations, supported by the fact that, so far as known, no hops have ever been introduced into Russia from Japan or America, and a consideration of the affinities of the fungus, which is regarded as a distinct species, lead the author to believe that *P. humuli* is a ubiquitous organism of long standing on wild hops wherever this host occurs. The recent epidemic outbreaks of the disease were probably brought about by the setting in of certain, as yet unascertained, ecological conditions, which increased the virulence of the fungus and caused it to pass from the wild to the cultivated hops. There is no evidence, so far as Russia and western Europe are concerned, to support the theory advanced by some workers of a spread of the fungus from the east westwards.

The paper terminates by very brief hints on control, based on Salmon's recommendations, and a bibliography of 30 titles is appended.

Salmon (E. S.). **The downy mildew problem in Germany.**—*Brewers' Journ.*, lxv, 3, pp. 155-156, 1929.

A popular account is given of the recent German investigations into the control of downy mildew of the hop (*Pseudoperonospora humuli*) by spraying with home-made Bordeaux mixture [cf. *R.A.M.*, viii, p. 525]. In the following programme the amounts of fluid given are those required per 1,000 hills.

The first application (0·75 to 1 per cent. mixture) is given when the bines are trained up; spraying should not be effected if the nights are cold, or the bine is not vigorous, as even 0·5 per cent. Bordeaux mixture will then severely scorch the leaves, all of which may fall. The second application (about 44 galls. of 1 to 1·5 per cent. mixture) is made when the bines are 9 to 10 ft. high, the third (about 66 galls. of 1·5 to 2 per cent. mixture) when they are 16 ft. high, and the fourth (about 110 galls. at the same strength) when they are near the top wire.

If these applications are carefully effected it will be found that the bines are well protected by a fungicidal deposit by the middle of July, when only the new growth, which is some 6 ft. long, should be sprayed, using 30 to 40 galls. of 1·5 to 2 per cent. mixture. The sixth application is made as the burr appears, and as the danger of infection is greatest at this period, 220 galls. should be applied if luxuriant heads and many fertile laterals are present; 1·5 to 2 per cent. mixture should be used if the burr is only just appearing, or 1 per cent. if some of the hills are in full burr. In Germany there is no objection to spraying during the burr stage, as fertilization is not necessary for the production of properly developed cones as in English varieties. Unless the season is

exceptionally dry, at least two further applications, each of about 500 galls. of 1 per cent. mixture, are necessary, and should be made at the onset of wet weather, to prevent the brown cone stage of the disease. Spraying should be discontinued 8 to 14 days before picking.

Numerous experiments showed that 1 per cent. Bordeaux mixture can safely be applied during and after burr, while the final application everywhere proved remunerative. Under Würtemberg conditions, the total cost of spraying 1,000 hills according to this programme, including labour, interest on and depreciation of the outfit, and cost of materials, is estimated at £10.

Notes are also given on the type of machinery used, the technique involved, and on cultural and sanitary methods that further facilitate control.

SALMON (E. S.) & GOODWIN (W.). **Notes on a visit to certain Hop-growing districts in Bavaria and Wurtemberg, with special reference to the control of downy mildew.**—*Journ. Inst. of Brewing*, N.S., xxvi, 2, pp. 75–80, 4 figs., 1929.

In July, 1928, the authors visited Hallertau, Bavaria, and Tettnang, Würtemberg, to study the measures being taken there to control downy mildew of the hop [*Pseudoperonospora humuli*: see preceding abstract].

The gardens visited had already been sprayed, on an average, seven times, and as the growers intended to continue spraying up to the time of picking, in most cases at least ten applications were made by the end of the season. The earlier practice of applying 0·5 per cent. Bordeaux mixture during burr had apparently been discontinued in favour of the usual 1 per cent. mixture.

At Hallertau some 90 per cent. of the growers had sprayed their crops systematically, and they were satisfied that the practice had adequately controlled the disease. As a rule, any spikes formed on the main bines or lateral shoots were removed as they appeared, spikes on lofty bines being cut off by means of a secateur on a long rod; this implement costs 1*s.* 6*d.*

In imperfectly sprayed or unsprayed gardens many bines were so severely attacked that lateral spikes were produced instead of fertile laterals. The extreme susceptibility of the Hallertau hop partly accounts for the severity of the disease in this district, as other varieties, such as those grown near Spalt, south of Nuremberg, are much more resistant.

No spreader was used with the Bordeaux mixture, the high pressures (20 atmospheres, or nearly 300 lb. per sq. in.) provided by the motor sprayers, and the type of nozzle used, resulting in a very fine and well distributed spray.

The latest pattern of self-driven spraying machine has a 6 H.P. motor and works at a pressure of 25 atmospheres (375 lb. per sq. in.) with two sprayers. The two chief makers appear to be Gebrüder Holder, Metzingen, and Carl Platz, Ludwigshafen.

A disease of the virus type was noticed in one or two gardens at Hallertau, resembling the nettlehead disease in England [*R.A.M.*, iv, p. 634], though the German plants very rarely showed incurved leaf margins, the leaves being more obviously mosaic mottled.

The condition appears to be known as 'Kräuselkrankheit' and seems to be identical with that found on Saaz hops in Bohemia [ibid., v, p. 127].

The growers encountered no difficulty in selling the sprayed hops, and German brewers raised no objection to the use of sprayed cones.

COOK (M. T.). **Life history of Ligniera vascularum (Matz) Cook (formerly known as Plasmodiophora vascularum.)**—*Journ. Dept. Agric. Porto Rico*, xiii, 1, pp. 19–29, 4 pl., 1929.

The life-history of the organism described in 1920 by Matz as *Plasmodiophora vascularum*, the cause of dry top rot of sugar-cane in Porto Rico (*Journ. Dept. Agric. Porto Rico*, iv, p. 41) [cf. *R.A.M.*, i, p. 317], is stated to resemble that of a number of other species of Plasmodiophoraceae.

In some cases the writer found the organism only in the tracheae of affected plants, while in others it occurred also in the surrounding cells of the fibro-vascular bundles. Both the plasmodium and spores were most abundant in the basal part of the plant but were sometimes found at a considerable distance above ground. The more mature stages are always below the less advanced ones, indicating the upward movement of the organism into the growing plant. The flagellate zoospores appear to become euglenoid, then amoeboid, and eventually unite to form a plasmodium. In the plasmodium uninucleate, yellow to brown spores, surrounded by a distinct wall, are formed, each of which germinates by liberating a zoospore through a short germ-tube, thereby completing the life-cycle. Judging from the author's observations the spores may apparently germinate in the tracheary tubes and unite to form a plasmodium, the organism passing from the older to the younger parts of the plant either as zoospores or as a plasmodium, and completing its life-history in the fibro-vascular bundles of the growing cane without leaving the host.

The formation of free swimming zoospores and the greater severity of the disease in wet soils suggest, however, that the organism is capable of passing from one plant to another through the soil, though it is not definitely known how healthy plants become infected.

There is no cell destruction or hypertrophy of the host tissues as in the case of other species of *Plasmodiophora*, and the author states that this is the character on which the genus *Ligniera* was erected (*Ann. Mycol.*, ix, p. 226, 1911; *Comptes rendus Acad. Sci.*, clii, p. 206, 1911). The data obtained in these studies thus indicate that the causal organism of dry top rot should be transferred from *Plasmodiophora* to *Ligniera*, and it is accordingly renamed *L. vascularum* (Matz) comb. nov., a revised diagnosis being given in English.

UNAMUNO (P. L. M.). **Nuevos datos para el estudio de los hongos parásitos y saprofitos de los alrededores de Durango (Vizcaya).** [New data relating to the study of the parasitic and saprophytic fungi of the environs of Durango (Vizcaya).]—

Bol. R. Soc. Española Hist. Nat., xxix, 3, pp. 113–126, 4 figs., 1929.

The following species in this list of 74 Spanish fungi are of phytopathological interest. *Uredo pinardiae* n. sp. was found in two localities of northern Spain on the leaves and shoots of *Chrysanthemum coronarium* (syn. *Pinardia coronaria*).

Ustilago maydis [*U. zeae*] is very prevalent on the ears, shoots, and leaves of maize in northern Spain.

Pleosphaerulina briosiana was found on lucerne leaves [*R.A.M.*, v, p. 272], this being the first record of its occurrence in Spain. The specimens differed from the type species in having somewhat larger spores (25 to 31·5 by 10·5 to 12·5 compared with 20 to 25 by 6 to 8 μ) and thus approximated to the var. *brasiliensis*.

Phyllosticta trifolii-minoris n. sp., occurring in association with *Uromyces trifolii-repentis* and *Darluca filum* on the leaves of *Trifolium minor*, is characterized by amphigenous, sphaeroidal or depressed oval, immersed, cinnamon-coloured pycnidia, measuring 75·5 to 83·5 by 66·5 to 73·5 μ; and by hyaline, simple, ovoid, straight or slightly curved spores, rounded at both ends, 3- to 4-guttulate, and measuring 5 to 7 by 2·5 to 3·5 μ.

Monochaetia rosae-caninae n. sp. was found in conjunction with *Septoria rosae*, *Phyllosticta rosae*, and *Cercospora* sp., forming circular, brown spots with purple edges on living leaves of *Rosa canina*. It is characterized by scattered light brown, subepidermal, epiphyllous acervuli, 80 to 85 by 30 to 40 μ; oblong, 4-septate conidia measuring 16 to 18 by 5 to 7 μ, the three middle cells dark and the two end ones hyaline; hyaline stalks almost equal to the conidia in length, and a conical apical beak with a filiform, hyaline, curved or hooked cilium.

Girzitska (Z.). **Fungi novi vel rari pro flora mycologia.** [Fungi new or rare in mycological flora.]—*Bull. Jard. Bot. Kieff*, vii–viii, pp. 78–79, 2 figs., 1928. [English.]

In the summer of 1926 the writer found, on *Ligustrum vulgare* in the Kiev Botanical Garden, an apparently new species of *Diplodia*, characterized by pycnidia measuring 250 to 350 μ, elongated, hyaline conidiophores, 15 to 20 by 4 to 6 μ, and brown, ovoid, uniseptate conidia, 60 to 70 by 25 to 30 μ. The fungus, which may possibly be parasitic on the privet branches, has been named *D. ligustricola* n. sp.

On the leaves of *Amygdalus* [*Prunus*] *nana* were observed light brown spots, studded with black dots, which proved to be the fructifications of an apparently parasitic *Colletotrichum*, causing defoliation. The organism, which seems to be a variety of *C. padi* (var. *amygdali nanae* n. var.), is characterized by acervuli measuring 200 to 250 μ in diameter, setae 70 to 80 by 4·5 to 6 μ, conidiophores 12 to 14·5 by 3·5 to 4·5 μ, and hyaline, falcate conidia, 13·5 to 18 by 3 to 3·5 μ.

Chardon (C. E.). **New or interesting tropical American Dothideales. II.**—*Journ. Dept. Agric. Porto Rico*, xiii, 1, pp. 5–17, 2 col. pl., 1929.

Descriptions are given of 22 species of Dothideales occurring in

Porto Rico, of which the following may be mentioned. *Trabutia mangiferae* n. sp. forms irregular or roughly circular, amphigenous, brownish brick-coloured spots, 12 to 15 mm. across, on mango leaves. The fungus is characterized by hypophyllous, black, shiny, irregular, angular, multilocular stromata, 3 to 5 mm. across, situated between the cuticle and the epidermis; cylindrical-clavate, paraphysate asci, measuring 62 to 75 by 15 to 17 μ and containing 8 biseriate, unicellular, hyaline, ellipsoidal spores, 10 to 12 by 5 to 6 μ in diameter.

Catacauma ingae n. sp., which forms roughly circular, yellowish, inconspicuous spots, 1 to 1·5 mm. in diameter, on *Inga vera*, possesses scattered, small, epiphyllous, circular, unilocular stromata, 0·5 to 0·8 mm. across, situated between the epidermis and the mesophyll, forming a clypeus over the locule, 45 to 60 μ thick; cylindrical-clavate, paraphysate asci, 75 to 90 by 13 to 15 μ, containing 8 inordinate, long-navicular, hyaline, continuous spores, 24 to 26 by 3·5 to 4 μ in diameter and provided with several oil-drops.

C. semi-lunata n. sp. is characterized by the formation, on *Eugenia* sp., of very conspicuous, epiphyllous, tar-like spots, coincident with the stromata, which often merge into large masses 6 to 10 mm. across, with 3 to 5 or more locules, and are located between the epidermis and the mesophyll; and cylindrical-clavate, paraphysate asci containing 8 biseriate, hyaline, unicellular, lunulate spores, 14 to 18 by 4 to 5 μ in diameter.

Robledia tetraspora n. g., n. sp., produces spots on *Eupatorium tacotanum* coincident with the epiphyllous, black, dull, warty, globose to sub-globose, multilocular stromata, 1 to 2 mm. across, situated between the epidermis and the mesophyll; it is further characterized by cylindrical or cylindrical-clavate, paraphysate asci, 45 to 62 by 12 to 18 μ, containing 4 uniseriate or biseriate, yellowish-brown, bicellular spores, with unequal cells, the upper long-elliptical, measuring 14 to 20 by 6 to 7 μ and provided with a cell wall 1 μ thick, and the lower papillate and 2 to 3 μ across.

HIROSHI (T.) & MORITA (S.). **Bibliographie von Aspergillus. 1729 bis 1928. Fortsetzungen I und II.** [Bibliography of *Aspergillus* from 1729 to 1928. Continuations I and II.]—*Bot. Mag.*, Tokyo, xliii, 507, pp. 145–156; 508, pp. 180–189, 1929.

The first of these articles comprises the titles of 151 papers relating to *Aspergillus* which appeared between 1870 and 1885, while the second covers the same field during the period from 1886 to 1893, inclusive.

GUBA (E. F.). **Monograph of the genus Pestalotia de Notaris. Part I.**—*Phytopath.*, xix, 3, pp. 191–232, 1 pl., 7 figs., 1929.

This is a critical study of 46 described species of *Pestalozzia* [the author prefers the old spelling *Pestalotia*], of which 30 are retained as distinct, with a review of the existing knowledge of their biologic relationship. In connexion with *P. guepini* [*R.A.M.*, viii, p. 520], the writer states that his investigations show this fungus to be restricted to *Camellia*, the forms on tea (*Thea*), palms, &c., being distinct species.

A key to the species included in the first part of the monograph and a four-page bibliography are appended.

DRECHSLER (C.). **The Beet water mold and several related root parasites.**—*Journ. Agric. Res.*, xxxviii, 6, pp. 309-361, 15 pl., 2 figs., 1929.

In this paper a full discussion is given of the morphology, cytology, and affinities of *Aphanomyces cochlioides*, the cause of a destructive root disease of sugar beet seedlings in the State of Michigan, an abridged description of which has already been given in a preliminary notice [*R.A.M.*, vii, p. 419]. Detailed descriptions are also given of several other related fungi, isolated from the roots of various hosts, namely: (1) The organism causing discoloration and death of rootlet tips of tomato seedlings in greenhouses in Washington, D.C., which was provisionally identified as *A. euteiches* [ibid., vi, p. 517]; a closer study, however, revealed rather definite morphological dissimilarities from the latter, especially in that the antheridia may be monoclinous or androgynous as well as diclinous, in the frequent insertion of the septum delimiting the antheridium at some little distance below the inflated part, and in the size of the oogonium and oospore. On these grounds the tomato organism is named *A. cladogamus*. (2) An organism collected in 1924 from the root of an oat plant in the State of Wisconsin, the pathogenicity of which, however, is not known. Although it approaches *A. cochlioides* in the dimensions of its oogonia and oospores, peculiarities in the arrangement of the sex organs show a greater similarity to *A. cladogamus*, but with a considerably more extensive helicoid disposition of the oogonial stalk about the antheridial hypha than in the latter species. The name *A. camptostylus* is suggested for this fungus. (3) *A. raphani* on radishes [ibid., vii, p. 4]. (4) An organism isolated from diseased roots of sugar-cane (*Saccharum officinarum*) in Louisiana in 1927, which was found to belong to the genus *Plectospira* recently established by the author [ibid., vi, p. 517]. Like *P. myriandra* it produces, in association with a specialized lobulate zoosporangium, an intricate sexual apparatus with an extraordinary number of antheridal elements, mostly non-functional. It differs from the latter, however, in the absence of parthenogenetic oospores, which are replaced by relatively large, subspherical asexual bodies, or gemmae, capable of surviving for several months, though not requiring any resting period for germination. On germination, these gemmae may give rise to germ zoosporangia, or, especially after some ageing, produce a vegetative mycelium. This species is named *P. gemmifera*.

All these species were tested in parallel series of greenhouse inoculations for their pathogenicity to sugar beet seedlings. In every case severe and sustained damping-off was caused by *A. cochlioides*. *A. cladogamus* and *A. camptostylus* caused the disease during the first week of the experiments, but later their parasitic activity entirely ceased. Inoculations with *A. euteiches* and *A. raphani* were rarely successful on sugar beet seedlings, while *P. myriandra* and *P. gemmifera* proved to be entirely innocuous to this host.

A detailed description is also given of a method of isolating

fungi from decaying host tissues, which was found especially useful in work with genera such as *Aphanomyces*, *Pythium*, and *Phytophthora*. This consists essentially in first placing pieces of the material in water; on the resumption of vegetative growth by the fungus, the pieces are taken out, the free water is thoroughly removed with absorbent paper, and transfer to agar plates is made in the usual manner.

HINO (I.). **Microconidia in genus Sclerotinia with special reference to the conidial forms in the genus.**—*Bull. Miyazaki Coll. Agric. and Forestry*, 1, pp. 67–90, 7 figs., 1929. [Japanese in roman script, with English summary.]

In this paper (which forms part of a graduation thesis submitted to the Tokyo Imperial University in 1923, and therefore makes no reference to literature published since that date) the author divides the microconidia-bearing sclerotial fungi into the following six forms, based on their conidial stages: (1) perfect form: species producing ascospores and *Botrytis* macroconidia, e. g., *Sclerotinia fuckeliana* [*R.A.M.*, vi, p. 644]; (2) the so-called 'conidia-lost' form, comprising species with ascospores but no macroconidia, e. g., *S. libertiana* [*S. sclerotiorum*]; (3) the modified form, including species with ascospores and secondary conidia of the *Monilia* type, which are essentially a sort of chlamydospore, e. g., *S. fructigena* [ibid., viii, p. 385]; (4) the *Botrytis* form, represented by species with *Botrytis* conidia but no ascospores or *Monilia* stage, e. g., *B. liliorum*; (5) the *Monilia* form: species with *Monilia* conidia but no ascospores or *Botrytis* macroconidia, e. g., *M. kenjiana*; and (6) the intermediate form, comprising species with doubtful ascospores and *Botrytis* macroconidia, with moniliform branches resembling *Monilia* spores, e. g., *S. moricola*. All the above have microconidia, attempts to germinate which failed, except in *S. trifoliorum*, where a few short germ-tubes were formed. There is considered to be no necessity for the establishment of subgenera in the genus *Sclerotinia*, the purpose of elucidation being better served by the definition of differential forms.

CHIVERS (A. H.). **A comparative study of Sclerotinia minor Jagger and Sclerotinia intermedia Ramsey in culture.**—*Phytopath.*, xix, 3, pp. 301–309, 4 figs., 1929.

Cultural experiments [details of which are given] were carried out at New York (Cornell) University in 1927 to determine the nature and extent of the variations occurring among different strains of *Sclerotinia minor*, isolated from lettuce in New York, potato and sunflower in Canada, and *Chrysanthemum cinerariaefolium* in Japan. *S. intermedia* was included in the tests for comparative purposes [*R.A.M.*, vii, p. 6]. The sclerotia of *S. minor* were found to vary consistently in size with the temperature at which they develop, being smaller at the lower limit of the range (9° C.) than at the upper (25°) [ibid., viii, p. 407]. In *S. intermedia*, on the other hand, the sclerotia were larger at the lower temperatures than at the higher ones.

HARVEY (C. C.). **Studies in the genus Fusarium. VII. On the different degree of parasitic activity shown by various strains of Fusarium fructigenum.**—*Ann. of Botany*, xliii, 170, pp. 245–259, 1929.

The experiments described in this paper were planned for the purpose of obtaining further data on the varying degree of parasitic activity on apple fruit of the strains of *Fusarium fructigenum* previously described by Brown [*R.A.M.*, vii, p. 475]. The results of the inoculations (which were made during two consecutive seasons) were studied by the statistical method devised by Horne and Gregory [ibid., vii, pp. 585, 586], and showed that the strains tested exhibited at least four grades of parasitic aggressiveness, correlated in a general way with the characters of the four morphological groups of strains established by Brown. The degree of virulence was highest in the strains showing the greatest tendency to the mycelial type of growth in pure culture, and gradually decreased in the strains characterized as 'sporodochial', 'pionnotal', and 'long-spored', in the order named. Although certain varieties of apples were found to be more rapidly attacked than others, there was no indication of selectivity on the part of the *F. fructigenum* strains, since the latter behaved much in the same way on one variety as on another. The virulence of each strain appears to be independent of such factors as the quantity of inoculum used, the kind of inoculum (spores or mycelium), and the physiological state of the inoculum.

BERTUS (L. S.). **Sclerotium rolfsii in Ceylon.**—*Ann. Roy. Bot. Gard., Peradeniya*, xi, 2, pp. 173–187, 2 pl., 1929.

After stating that *Sclerotium rolfsii* was found in Ceylon attacking groundnut plants either alone or in association with *Rhizoctonia* (*Corticium*) *solani* [*R.A.M.*, vi, p. 389], the author briefly describes the cultural characters of the former on various media, and discusses at some length the results obtained by him in inoculation experiments with it on a wide range of plants [a list of which is given]. These experiments showed that *S. rolfsii* is able to cause damping-off of the seedlings of certain plants, when it is brought in contact with the stems, but that some plants which are susceptible to infection in their early stages become immune with age. On a number of hosts, e. g., chilli, tomato, *Piper betle*, and groundnut, it caused a stem disease or a collar rot, its usual point of attack being the collar of the plants. Other pathological symptoms caused by it were a root disease of *Alocasia cucullata* and radishes, a damping-off of young shoots of potato, sweet potato, and *Delphinium*, and a leaf roll of *Colocasia antiquorum*. The conditions that appeared to be necessary for the fungus to become pathogenic on seedlings were its presence in the upper four inches of the soil, high temperature, and high humidity.

In discussing the identity of the Ceylon strain of *S. rolfsii*, the author states that he found it to be indistinguishable from the fungus known in India as *Rhizoctonia destruens* [ibid., viii, p. 18], and also from *Sclerotium zeylanicum* [*R.A.M.*, vi, p. 390].

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Baudyš (E.). **Škodlivost plísně šedé (Botrytis cinerea).** [The damage done by the grey mould fungus (*Botrytis cinerea*).]—*Ochrana Rostlin*, ix, 1, pp. 9–15, 7 figs., 1929.

In this popular note the author states that considerable damage is done in Czecho-Slovakia by *Botrytis cinerea* to all kinds of vegetables in storage, and also to many crops in the field. Of the latter the most important is the vine, the leaves and shoots of which are attacked from June onwards, while considerable damage is done to the grape bunches later in the season. Great losses are also caused by the mould to flowers, whether grown under glass or in the open. Especially virulent was an outbreak on dahlias in 1927 in Moravia, which in many localities entirely destroyed the blossoms. Experiments indicated that the disease on this host may be successfully controlled by spraying the plants with a 1 per cent. solution of solbar or a 0·1 per cent. solution of sulikoll.

Mitter (J. H.). **Studies in the genus Fusarium. VII [? VIII]. Saltation in the section Discolor.**—*Ann. of Botany*, xliii, 170, pp. 379–410, 2 pl., 2 diags., 10 graphs, 1929.

The purpose of the investigation fully reported in this paper was to make a comparative study of the saltants that had been obtained in the course of the author's previous work in collaboration with Horne [*R.A.M.*, vii, p. 109] from strains of *Fusarium culmorum*, *F. polymorphum*, and *F. sulphureum*, on the one hand, and of a number of available strains of *Fusarium* of the *Discolor* section [a list of which is given], on the other. The main characters considered were the rate of radial advance, mycelial development, colouring of the substratum, method of sporing, and the shape and septation of the spores. A description is also given of the mode of origin of the saltants studied and of their salient morphological characters.

The results indicated that, as far as the species of *Fusarium* belonging to the *Discolor* section are concerned, specific characters are not distinctive, since a greater divergence in critical characters may be observed in saltants from a given original strain than between one so-called species and another. It follows from this

that the criteria hitherto used for the sectional grouping of the recognized species, e. g., spore shape, nature of substratal colouring, chlamydospores and their disposition, presence or absence of microconidia, and the like, are entirely inadequate, the more so since saltants derived from a given strain may show spores of more than one sectional type.

Ten of the *Discolor* strains and saltants tested were found capable of causing decay in the Cox's Orange Pippin variety of apple with a greatly varying degree of aggressiveness. The saltants tested were less virulent than their respective parent strains.

SMALL (W.) & BERTUS (L. S.). **On the parasitism of Sphaerostilbe repens B. and Br.**—*Ann. Roy. Bot. Gard., Peradeniya*, xi, 2, pp. 189–202, 2 pl., 1929.

After a brief review of the existing literature on the relationship of *Sphaerostilbe repens* to root diseases of woody plants in the tropics, the authors state that in 1926 and 1927 the fungus was recorded in Ceylon on various species of trees [a list of which is given]. In several cases the presence of *S. repens* could be correlated with damp or sour conditions of the soil, but in others the hosts were growing under normal conditions. It was found, however, in all the cases that were thoroughly investigated, that *Rhizoctonia bataticola* [*Macrophomina phaseoli*] was also present on the diseased roots under circumstances which indicated that the latter fungus was the primary, and *S. repens* a secondary organism.

In order to obtain more definite information on the parasitism of *S. repens*, the fungus was grown in pure culture on various media [the cultural characters on these media being described at some length], and the cultures were used in inoculation experiments on different hosts. The results showed that, under the conditions of the tests, *S. repens* was unable to attack healthy roots of the woody plants tested, namely, tea, *Hevea* rubber, and dadap (*Erythrina lithosperma*), or of rubber and cacao seedlings, even when the roots were wounded and the inoculum was placed in close contact with the injured roots. Of twelve plants of arrowroot (*Maranta arundinacea*) tested, however, one was attacked by the fungus, the upper part of the rhizome in the region of the shoot becoming discoloured, while the lower part remained healthy. Rhizomes of a species of *Canna* which were inoculated on the cut surfaces and then planted in sterilized soil, produced shoots that died back when they were about 6 inches high, i. e., seven weeks after inoculation. The bases of the shoots and the rhizomes were discoloured and contained typical chlamydospores and hyphae of the fungus. On papaw (*Carica papaya*) the fungus was shown to be able to produce a collar rot, but it did not infect lateral roots with readiness.

In the discussion of these results, the authors interpret them as supporting previously expressed views in regard to the primary part played by *R. bataticola* in the causation of root disease of woody plants. They do not deny, however, that attack by *S. repens* on woody roots may be a secondary phenomenon which follows upon moist or sour conditions of the soil.

TUNSTALL (A. C.). **Fungi on Tea roots.**—*Quart. Journ. Indian Tea Assoc.*, *1929*, 1, pp. 1–10, 1929.

Popular notes are given on the symptoms, life-history, distribution, and control of the following fungi attacking tea roots in India: *Rosellinia arcuata* [*R.A.M.*, viii, p. 69], *Ustulina zonata* [ibid., viii, pp. 203, 267], *Kretzschmaria micropus* (probably identical with the foregoing) [ibid., iv, p. 375], reported for the first time on tea, and *Sphaerostilbe repens* [ibid., vii, p. 543].

LIKHITÉ (V.). **The nature and relations of the intracellular inclusions present in the mosaic of Tobacco.**—*Meded. Landbouwhoogeschool te Wageningen*, xxxiii, 1, 30 pp., 2 pl., 1929. [Dutch summary.]

A full description is given of the author's investigations on the nature of the intracellular inclusions associated with tobacco mosaic [*R.A.M.*, vi, p. 261; vii, pp. 256, 797]. The material examined consisted of fragments of healthy and diseased stems of tobacco and other plants, which were fixed for 24 to 48 hours in a solution of equal parts of 6 per cent. potassium bichromate, 1 per cent. chromic acid, and 2 per cent. osmic acid, washed for 12 hours in running water, placed for a week in 2 per cent. osmic acid at 30° C., again washed, embedded in paraffin, sectioned, and mounted without further staining. In this way the protoplasm and nuclei were stained a uniform pale yellow, the crystalloid material deep yellow, and the vacuolate bodies dark. The inclusions were found to occur only in the diseased plants, but were found in all the tissues of these.

The tendency of the vacuolate bodies is to decrease in size towards the peripheral tissues (epidermis, hairs, &c.), in which they appear as minute, deeply stained globules corresponding to Klebahn's miculae [ibid., vii, p. 797]. They were found in the packets of crystals. In a slightly larger form they have one vacuole in the granular substance, the osmiophile nature of which relates it to the mitochondria or other cell constituents. The vacuolate bodies have an autonomous movement. Blunt pseudopodia are often thrown out by the smaller bodies and the vacuole may be extended into them. Occasionally a whole body may be observed to extend into a long, pseudopodium-like protuberance with more vacuoles and granular structure in the front end. These bodies can penetrate the cell wall and they commonly pass from one cell to another. A single vacuole was observed only in the smaller forms, any increase in size being accompanied by an immensely augmented number of vacuoles. The average dimensions of the vacuolate bodies were 6 by 4 μ, with a maximum of 10 by 7 μ. In the wood vessels the vacuoles are much enlarged, and occupy the greater part of the bodies. A cluster of these bodies may be seen from time to time surrounding the nucleus, over which they even seem to pass without causing any apparent injury.

Division of the bodies by constriction is very common, and the thread of protoplasm uniting the two individuals may remain attached for a long time. Conjugation in pairs was frequently observed, and after this process minute granules are formed in the vacuoles and in the bodies themselves, and are often set free and

left behind in the movement of the latter; very likely these granules become distributed throughout the epidermal tissue, and the various types of granular matter described by other authors are considered to be identical with them. The granules may give rise to a new body under favourable conditions.

The writer's observations have convinced him that the various types of crystals (acicular, polyhedral, crescent-shaped, and striated) are secreted by the vacuolate bodies. Klebahn's view [loc. cit.] that these organs represent an albuminous metabolic product of the diseased individuals was confirmed by these studies. The crystals are so closely associated with tobacco mosaic virus [ordinary tobacco mosaic: ibid., vi, p. 501] that they may almost be considered as a criterion for this disease. In the writer's experiments, tobacco mosaic was transferred by grafting to tomato, *Petunia hybrida*, *Solanum nigrum*, and *Hyoscyamus niger*, a cytological examination of which revealed the presence of crystals in the epidermal tissues and hairs. In 1928 all the above-mentioned types of crystals were also found in the cells of Rural New Yorker potato plants affected by tobacco mosaic.

Discussing the nature of the vacuolate bodies, the author rejects as misleading the various names hitherto applied to them. He regards them as representing a living parasitic organism, for which he proposes the name of *Vacuolarium ivanowski* n. g., n. sp. (with English diagnoses).

A tabular index to the vacuolate bodies found in different plants is given in the form of an appendix, together with a bibliography of 43 titles.

MILLER (MARIE S.). К изучению рябухи на Махорке. Опыты **1927** года. [Contribution to the study of 'ryaboukha' on Indian Tobacco. Experiments in 1927.]—*La Défense des Plantes*, Leningrad, v, 5–6, pp. 601–608, 3 figs., 1929.

The investigation described in this paper was undertaken at the Physiological Section of the Acclimatization Station of Detskoye Selo [near Leningrad] for the purpose of determining the true nature of the disease of Indian tobacco (*Nicotiana rustica*) locally known under the name of 'ryaboukha' [pock-marks] and hitherto believed to be a physiological trouble, mainly due to disturbances in transpiration [*R.A.M.*, vii, p. 765]. The results of the experiments [details of which are given] and the histological study of diseased material tended to disprove this theory, since the symptoms could not be produced on healthy plants submitted to varying conditions of humidity and temperature, and the nature of the lesions rather pointed to the disease being caused by a parasitic organism. In this work no attempt was made, however, to determine the nature of the latter. No evidence was found that the disease is due to a deficiency of potassium in the soil.

KOCHANOVSKAYA (LUDMILLA N.). Исследования над рябухой на Махорке. Опыты **1928** года. [Investigation of 'ryaboukha' of Indian Tobacco. Experiments in 1928.]—*La Défense des Plantes*, Leningrad, v, 5–6, pp. 609–612, 3 figs., 1929.

Continuing the investigation of the 'ryaboukha' disease of

Indian tobacco (*Nicotiana rustica*) [see preceding abstract] the author states that she has established the presence in the diseased tissues of a short bacterial rod, easily stainable with methylene blue. The organism has not yet been isolated. A further indication of the parasitic nature of the disease was given by the successful infection of healthy tobacco plants with the juice from crushed infected leaves, inoculation being equally successful through the uninjured and wounded (pricked) epidermis; the symptoms thus produced were identical with those that occur in nature. The great similarity is pointed out of 'ryaboukha' with the disease known as wildfire (*Bacterium tabacum*) in America, and further work is in hand to determine whether they are not identical.

ANDERSON (P. J.) & SWANBACK (T. R.). **Report of the Tobacco Substation 1928.**—*Connecticut Agric. Exper. Stat. Bull.* 299, pp. 145–203, 7 figs., 1 graph, 1929.

This report contains (p. 194) the following reference of phytopathological interest. Experiments have been continued with strains of Havana Seed, Broadleaf, and Shade Cuban tobacco resistant to black root rot [*Thielavia basicola*: *R.A.M.*, vii, p. 810]. Wisconsin Havana No. 142 has again showed marked resistance to this disease, and produces a heavier yield of leaf than any of the ordinary Connecticut Havana Seed strains. Broadleaf is less susceptible to root rot than the other two types under observation, but the reduction in yield from this cause is sufficiently serious to have led to attempts to develop resistant strains, one of which is promising both in respect of production and resistance to root rot. Attempts are also in progress to develop a resistant Cuban strain from the seed of some scattered plants which made normal growth in the midst of a heavily infected field.

DETWILER (S. B.). **Insect and disease control as a branch of forest protection.**—*Yale Univ. School of Forestry Publ.*, 28 pp., 1929.

In this lecture, delivered at Yale University on 16th May, 1927, the principles of insect and disease control in connexion with forest protection are discussed under the following headings: (*a*) control as related to general crop production, comprising sections on plant pests in relation to crop production, protective measures against plant pests, scope of quarantine action, and the need for scientific investigation and cleaner crop production; and (*b*) the duties of individual foresters and of the forestry profession in pest control, with observations on the methods applied to the control of recently introduced pests, as well as to that of native ones.

BUCHTA (V.). **Nemoci Ořechových stromov.** [Diseases of the Walnut.]—*Ochrana Rostlin*, ix, 1, pp. 21–22, 1929.

Very brief notes are given on the principal fungal diseases of the walnut (*Juglans regia*) that occur in Czecho-Slovakia, all of which are well known. Some hints on control are also given.

TOMSA (K.). **Předčasné opadávaní listů Ořechu vlašského.** [Premature shedding of Walnut leaves.]—*Ochrana Rostlin*, ix, 1, pp. 17–19, 1 fig., 1929.

A very brief account is given of a premature defoliation of walnut trees [*Juglans regia*] which was observed at the end of June, 1928, in a locality of south-east Bohemia, and which was caused by *Marssonia* [*Marssonina*] *juglandis*, the conidial stage of *Gnomonia leptostyla*. In about 50 per cent. of the material examined, the fungus (which so far had only been reported to cause a spotting of the leaves) was found attacking the petioles and the main veins of the leaflets, which dried up and finally broke off at the point of attack. In pointing out the latent danger presented by this new manifestation of the fungus, the author states that the disease may be best controlled by the immediate removal and destruction by fire of all infected leaves, and by preventive sprayings of the trees with 1 per cent. Bordeaux mixture.

VOGLINO (P.). **Il servizio di controllo fitopatologico sulle Castagne destinate agli Stati Uniti d'America nella campagne 1928 esercitato dal R. Osservatorio di Fitopatologia di Torino.** [The phytopathological control service for Chestnuts destined for the United States of America undertaken during 1928 by the Royal Phytopathological Observatory of Turin.]—*Nuovi Ann. Agric.*, viii, 3–4, pp. 319–344, 1928.

After citing the regulations recently issued by the Italian Minister of National Economy by which chestnuts destined for export to the United States cannot be dispatched unless accompanied by a duly authenticated certificate of disinfection issued by an official observatory of plant pathology, and quoting the conditions which must be fulfilled before such certification is granted, the author gives a fully detailed account of various methods of disinfection (either by immersion in water or fumigation) used against attack by the insects *Carpocapsa* [*Cydia*] *splendana* var. *reaumurana* and *Balaninus elephas* [cf. *R.A.M.*, vii, p. 384]; details are also given of experiments in which chestnuts artificially infected with the spores of a species of *Mucor*, *Trichothecium roseum*, and *Penicillium crustaceum* isolated from chestnuts kept for about one month in the barrels used to export the fruit, or sprayed with water suspensions of the same organisms, were treated with various [named] disinfectants. In the only cases in which fungal growth was inhibited, however, the treatments so adversely affected the fruit as to make it unmarketable.

Chestnuts growing in the vicinity of Boves and Cuneo were found to be infected by *Phoma endogena*, while some of the former also showed the presence of *Sclerotinia pseudotuberosa*.

CLINTON (G. P.) & MCCORMICK (FLORENCE A.). **The Willow scab fungus Fusicladium saliciperdum.**—*Connecticut Agric. Exper. Stat. Bull.* 302, pp. 443–469, 8 pl., 1929.

Willow scab (*Fusicladium saliciperdum*) [*R.A.M.*, iv, p. 199; vii, p. 129; viii, p. 275] was first observed at Norfolk, Connecticut, late in June, 1927, this being apparently the first record of the

fungus in a parasitic state for North America. Subsequently it was found in various other eastern States and in eastern Canada.

The disease attacked *Salix alba*, *S. alba* var. *vitellina*, *S. cordata*, *S. discolor*, *S. lucida*, *S. nigra*, *S. pentandra*, *S. sericea*, and various undetermined species. Of these *S. alba* var. *vitellina* and *S. cordata* appear to be the most susceptible, while *S. pentandra* is relatively resistant. Many of the trees in the affected stands of *S. alba* var. *vitellina* are believed to be doomed.

The fungus hibernates on young twigs infected in the previous year. In the spring the *Fusicladium* stage develops on these twigs, the spores being washed down on to the very young leaves in the opening buds. Under humid conditions even fully grown leaves suddenly rot on the trees, and then gradually fall off. On young leaves the rot often spreads down the mid-rib to the petiole. The tissues of the young twigs may thus be reached, causing cankers of varying severity. If girdling occurs the twig soon dies, together with the attached leaves above the point of attack. The dead twigs and leaves assume a reddish-brown or blackish colour according to the species of willow, and may bear the fructifications of the fungus, which appear as small, dense, olive-brown pustules chiefly following the course of the larger veins, especially the mid-rib.

A detailed description of the morphology of the fungus is given. Rudimentary perithecia, possibly those of *Venturia chlorospora*, the perfect stage of *F. saliciperdum*, were occasionally found both in nature and in culture, but so far these bodies have not been brought to maturity.

Of the various other fungi [which are enumerated] found in association with *F. saliciperdum* on diseased willow leaves and twigs, the only ones considered as potential parasites are a species of *Gloeosporium* and one of *Physalospora*, the latter apparently agreeing with the organism described by Nattrass [loc. cit.] as *P. miyabeana* and also closely resembling *Glomerella cingulata*. So far only a few preliminary inoculation experiments have been carried out with the *Physalospora* and none with the *Gloeosporium*, and therefore their pathogenicity cannot yet be definitely established. In any case, they are believed to be merely secondary parasites, whereas the results of infection tests [which are described and tabulated] on five varieties of *Salix* with *F. saliciperdum* demonstrated the active parasitism of this fungus.

Encouraging results in the control of the disease were given by spraying with Bordeaux mixture (4-4-50) or commercial dry lime-sulphur (3 lb. per 50 galls. water).

In conclusion a brief account is given of the European history of *F. saliciperdum*, with notes on its synonymy, hosts, and distribution. A bibliography of 78 titles, accompanied by concise indications of the subject-matter of the papers, is appended.

HOCQUETTE (M.): **Les réactions parasitaires des cellules d' Alnus glutinosa infectées par une Hyphoidée.** [The parasitic reactions of the cells of *Alnus glutinosa* infected by a Hyphoideae.]—*Comptes rendus Soc. de Biol.*, c, 11, pp. 881–882, 1929.

The roots of alder (*Alnus glutinosa*) at the Besse-en-Chandesse

(Puy-de-Dôme) Biological Station were found to be infected by bacteria which penetrate the cells by means of mucous filaments. The invaded cells immediately react by hypertrophy of the nucleus, the diameter of which may increase to three or four times the normal (from between 5·5 and 6·3 to 22·2 μ, the corresponding extension of the nucleoli being from 1·3 up to 5 μ). The average dimensions of healthy cells are 30 by 17 μ, compared with 58 by 40 μ for infected ones.

SAVULESCU (T.) & RAYSS (T.). **Une maladie du Pinus pumilio dans les Carpathes.** [A disease of *Pinus pumilio* in the Carpathians.]—*Rev. Path. Vég. et Ent. Agric.*, xvi, 2, pp. 65–68, 1929.

The authors state that *Neopeckia coulteri* (Peck.) Sacc. is known in Europe only in the Carpathian mountains, where it covers the needles of *Pinus pumilio* with a brown felt. The fungus does not penetrate the host tissues except by haustoria which traverse the cuticle and assume a spherical shape on reaching its inner surface. All the living tissues of the leaves are gradually destroyed, but lignified cells do not appear to be affected. The specific action of the fungus on cellulose is probably due to the secretion only of cytases and not hadromases.

The asci are cylindrical, 136 to 200 by 14 to 20 μ, and contain 8 bicellular, elliptical ascospores constricted in the middle and surrounded by a thick brown membrane. They measure 20 to 27 by 7 to 10 μ and the lower cell tapers at the end and is shaped like a comma. The paraphyses are long and filamentous.

N. coulteri grows abundantly on the snow-covered branches of *P. pumilio* which touch the ground, being apparently favoured by the humid atmosphere under the snow.

NANNIZZI (A.). **Un caso raro di 'alternariosi' del Pinus pinea L.** [A rare case of 'alternariosis' of *Pinus pinea* L.]—*Atti R. Accad. Fisiocritici Siena*, Ser. X, iii, 8–9, pp. 966–968, 1929.

At the end of August, 1928, the author observed a blackish-brown decay of the seeds of externally sound cones of *Pinus pinea* at Sienna. Isolations from diseased material yielded a fungus with brownish green hyphae and lageniform, rostrate, olivaceous to fuliginous conidia, measuring 45 to 50 by 10 to 14 μ, with 3 to 5 (occasionally 6) transverse, and 1 to 2 longitudinal septa. The fungus was identified as *Alternaria tenuis* [*R.A.M.*, vii, p. 417]. The parasitic development of this common saprophyte is attributed to the humid conditions prevailing during the winter and spring preceding the ripening of the cones.

SNELL (W. H.). **Some observations on the White Pine blister rust in New York.**—*Phytopath.*, xix, 3, pp. 269–283, 1 fig., 2 graphs, 1929.

Since 1922 the writer has been engaged on a study, for the New

York Conservation Department, of the damage caused by white pine blister rust (*Cronartium ribicola*) in the Adirondack Mountains [*R.A.M.*, viii, p. 1].

Observations in connexion with the respective parts played by the different spore forms of the fungus have shown that the aecidial stage not only initiates the cycle but is the primary agent of long-distance dissemination. The uredo stage is responsible for the production of spores on *Ribes* giving rise to an abundance of purely local lesions, which serve to increase the number of teleutospores and the subsequent sporidial formation. The sporidia are agents of limited local dissemination, their main function being the reinfection of pines to complete the cycle.

Between 60 and 70 per cent. of the cankers initiated before 1925 on white pines in the Adirondack Mountains occurred on 1919 wood. The epidemic of 1925 appears to have been as severe as that of 1919, if not more so. The 1927 season also seems to have been favourable for heavy pine infection.

The first critical point in the history of blister rust is the introduction of the disease into a given locality by means of wind-blown aecidiospores which infect *Ribes*. The second is local infection through the uredospores, leading to a gradual increase of the *Ribes* rust from year to year, and at the same time the fungus becomes established in the pine stands and produces aecidiospores which increase the *Ribes* infection. The third stage is the initiation of waves of infection under specially favourable conditions for the spread of the rust; and the fourth is the stage at which maturing trees begin to die from the attacks of the fungus.

In the Adirondack Mountains, where only 11 per cent. of the trees under observation are dead and 19 per cent. of the doomed individuals are still alive, the peak of the damage has not yet been reached. Owing to the scarcity of *Ribes* or absence of favourable infection conditions in certain sections, the white pine will not be generally destroyed, but in other areas, e. g., that of Kelm Mountain, 90 per cent. of the trees are already diseased and at least 87 per cent. doomed. In the writer's opinion, the importance of the conception of the gathering momentum of blister rust over a period of years has not yet been entirely appreciated.

The incidence of mortality among infected white pines was found to decline with the increasing age of the trees at the time of attack. This is explained by the fact that on older trees the fungus takes longer to travel from the point of infection on the branch to the stem, the only place at which the tree can be killed; in the meantime the rust may be destroyed by shade, fungi, insects, or rodents, thus giving the pine a chance of escape. Forty-five per cent. of the cankers on the experimental plots are now dead as the result of various forms of injury. On one lot 57 per cent. of 1,500 cankers were dead in 1925.

The curve presented by Posey and Ford [ibid., iv, p. 199], showing that blister-rust infection varies inversely with the density of stocking, is criticized as misleading, since it has not been found to hold good under conditions where there is sufficient infection to provide a fair test.

WAKSMAN (S. A.) & STEVENS (K. R.). **Processes involved in the decomposition of wood with reference to the chemical composition of fossilized wood.**—*Journ. Amer. Chem. Soc.*, li, pp. 1187–1196, 1929.

The writers' investigations and those of others [which are briefly summarized] have shown that the decomposition of wood under anaerobic conditions, e. g., in peat bogs or in the process of fossilization, brings about the disappearance of the celluloses and hemicelluloses and a marked accumulation of the lignin complexes [*R.A.M.*, viii, pp. 347, 476]. There is no basis for the assumption that in the decomposition of wood, oxycelluloses are formed as an intermediary step in the production of humus from celluloses. It has been ascertained that peat bogs are teeming with life (largely bacterial) and are not sterile, as frequently supposed.

SCHMITZ (H.). **Laboratory methods of testing the toxicity of wood preservatives. With a suggested improvement of the agar plate method.**—*Indus. & Engin. Chem., Analyt. Edn.*, i, 2, pp. 76–79, 1 fig., 1929.

Broadly speaking, the toxicity of wood preservatives may be determined by either of two general methods. The first consists in determining the resistance to decay of wood impregnated with the toxic material. The wood may be either in blocks or in the form of fine sawdust. In the second method the toxic material is added to nutrient agar cultures of the wood-destroying fungi in order to ascertain its inhibiting effect on the growth of the latter. The principal contemporary literature bearing on these methods [some of which has been noticed in this *Review*: cf. *R.A.M.*, vii, p. 484] is briefly summarized and discussed in the light of recent investigations.

One of the main difficulties attending the use of the agar plate method lies in the sterilization without alteration of the preservative, especially of volatile substances, such as coal-tar creosote. In order to prevent the loss of any preservative by volatilization, the author places definite amounts of the substance to be tested in small glass bulbs, which are then sealed, weighed, and transferred to glass-stoppered Erlenmeyer flasks with a sufficient quantity of nutrient culture medium to make the desired concentration. During sterilization the flask is plugged with cotton, the glass stopper being tied to the flask. After sterilization the cotton plug is removed and the bulb containing the preservative broken with a sterile glass rod. The glass stopper is inserted and the flask shaken to emulsify the mixture, which is poured into sterile Petri dishes.

SNELL (W. H.). **The use of wood discs as a substrate in toxicity tests of wood preservatives.**—*Proc. Amer. Wood Preservers' Assoc., 1929*, pp. 126–129, 1929.

The writer has obtained excellent results in toxicity tests of timber preservatives by the use as a substratum of planed wood disks 3 inches square by $\frac{1}{8}$ inch thick, trimmed at the corners to fit 100 mm. Petri dishes. Sitka spruce [*Picea sitchensis*] was used for

coniferous wood-destroyers and yellow poplar [*Liriodendron tulipifera*] for hardwood-destroyers. The disks were soaked for several days in the preservative compound to be tested, dried at room temperature, placed on sterile wood strips resting on moist filter paper in the Petri dishes, inoculated with the appropriate organisms under sterile conditions, and incubated at 29° C. or room temperature for a week or more. The advantages of this entirely natural method over those involving the use of nutrient agar or sawdust are briefly outlined.

Shipley (G. B.). **Trend of the wood-preserving industry in the United States.**—*Proc. Amer. Wood Preservers' Assoc., 1929*, pp. 76–97, 3 graphs, 1929.

The total quantity of railway sleepers, miscellaneous timber, and forest products of all kinds treated with preservatives in the United States in 1927 was estimated by the Forest Service at 4,150,000,000 board feet. Twenty years ago sleepers constituted 82 per cent. of all the material treated, whereas to-day they form only 64 per cent. of the total, though about 74,000,000, or 72 per cent. of the total number purchased, received treatment in 1927.

Zinc chloride is now used only on 13 per cent. of all treated material, compared with 43 per cent. 20 years ago. The consumption of dry zinc chloride in the United States in 1928 was 20,000,000 lb. compared with 51,000,000 lb. in 1921.

Creosote oils are more widely used (on about 88 per cent. of all treated material, compared with 68 per cent. 20 years ago). The consumption of creosote oils in the United States in 1927 was about 220,000,000 galls., or 4 times the amount used 20 years ago and 2½ times that of 5 years ago [*R.A.M.*, v, p. 200]. The estimated requirements for 1928 are some 225,000,000 galls. About 60 per cent. of all the creosote oil now in use is manufactured in American distilleries and the balance imported, whereas 25 years ago only 25 per cent. was produced at home.

Petroleum mixtures are now used on 15 per cent. of all treated material, consuming 23,000,000 galls., whereas 20 years ago this process was only in the experimental stage. Very good results have been obtained by mixing petroleum oil, watergas-tar, or coal-tar with zinc chloride or creosote oil [ibid., viii, p. 4].

Various other preservatives are used on 1·7 per cent. of all treated material.

The remainder of the paper deals with various technical aspects of the wood-preserving industry.

Blaess (A. F.). **Twenty-five years of timber treatment on the Illinois Central System.**—*Proc. Amer. Wood Preservers' Assoc., 1929*, pp. 162–169, 1929.

Since 1903 the Illinois Central Railway System has treated 52,009,662 railway sleepers, 166,004,239 feet board measure of timber, 27,565,763 feet board measure of switch ties, and 12,970,450 linear feet of piling. Chloride of zinc was employed exclusively for the treatment of sleepers from 1903 to 1907, when the use of creosote oil was commenced. The zinc chloride process gave fairly good results on the lines north of the Ohio River and west of

Chicago, but was less successful for sleepers in the territory south of the Ohio River, doubtless on account of the greater humidity in the latter region [see next abstract]. Since 1921 the use of zinc chloride has been entirely discontinued in favour of the creosote treatment, which appears to be better adapted to climatic conditions on the lines operated by the Central System. In 1927, 95 per cent. of all the sleepers laid down were treated with creosote oil.

The bulk of the treated sleepers consist of red oak [*Quercus rubra*]. White oak [*Q. alba*] was formerly used without treatment, but latterly this wood appears to have become coarser-grained and more porous, and the application of a preservative is necessary. Louisiana red cypress [*Taxodium distichum*] continues to give long service without treatment.

Some further figures are given in connexion with bridge timber, creosoted water tanks (the estimated life of which is 40 years compared with 30 for the best untreated wood), and the framing of structural timber prior to treatment.

BATEMAN (E.). **Relation of atmospheric humidity to concentration of zinc chloride solution.**—*Proc. Amer. Wood Preservers' Assoc., 1929*, pp. 120–125, 3 graphs, 1929.

In order to determine the relation of atmospheric humidity to the concentration reached on exposure by zinc chloride solutions, eight solutions of different concentrations from 2 to 50 per cent. were placed in battery jars in the laboratory of the treating plant of Albuquerque, New Mexico, for a period of 32 weeks (16th April to 27th November, 1928), during which the relative humidity of the air ranged from 20 to nearly 70 per cent. The strength values were determined periodically by means of a hygrometer. The highest concentration (63·5 per cent.) was attained by the 50 per cent. solution on 24th July; on the same date the 2 per cent. solution had evaporated to a concentration of 57·4 per cent. and the others were between these two figures. Subsequently the concentrations decreased. On 26th November the lowest concentration was 48 per cent. and the highest 58 per cent. In relation with the humidity these concentrations were approximately what would be expected from theoretical considerations, and it seems likely that the upper surface of treated sleepers would contain concentrations of much the same order, though the lower side, if in contact with moist soil, would probably be more dilute.

The data [which are tabulated] from this experiment are considered to show that the extremely high concentrations that may be attained may act as solvents for cellulose, and it seems very probable, therefore, that the presence of even small amounts of such concentrations would accentuate the natural tendency to checking and splitting of railway sleepers.

WILSON (T. A.). **Lumber treating by non-pressure process.**—*Elec. World*, xciii, 17, pp. 823–824, 1 diag., 1929.

It has been found possible, by the non-pressure process, to secure full sapwood penetration of practically every species of wood in commercial use. The non-pressure process should not be confused

with dipping (usually confined to submersion for 5 to 15 minutes in hot creosote), as the former requires 4 to 36 hours. The equipment of the Baltimore Consolidated Gas, Electric Light and Power Company consists of one 20,000 gall. cold storage tank, one 7,500 gall. hot storage tank, two open top treating tanks each 7 ft. × 14 ft. × 10 ft. deep for butt-treating of poles, and one tank 4 ft. × 4 ft. 8 in. × 41 ft. long, furnished with a removable cover, for the treatment of lumber and other timber. Recording thermometers register on 24-hour charts the temperatures of creosote in each of the storage and treating tanks. Steam from a boiler is furnished to a circulating heater, through which the preservative is forced by motor-driven pumps to and from the treating and storage tanks as required. By this means the temperature of the preservative may be raised one degree per minute in the hot storage tank, and at the same time thorough agitation is ensured. The circulating heater is also equipped for use as a cooler by the substitution of water for steam.

With this process of uniform temperatures under control it has been possible to determine by means of repeated tests at 200° F. and at each 5° interval up to 240° with several different species and dimensions of wood, the most appropriate temperatures to be used for a given charge.

VORONOFF (A. I.). **Use of mixtures of petroleum products and creosote for preservation of timber.**—*Journ. Chem. Ind.*, Moscow, v, pp. 1227–1230, 1928. [Abs. in *Chem. Abstracts*, xxiii, 11, p. 2802, 1929.]

It was shown by experiments that the stability of the different creosote fractions in benzene increases with the decrease of the boiling points of these fractions; thus, the creosote fractions boiling below 350° dissolve in benzene without forming a noticeable precipitate, whereas higher boiling creosote fractions produce precipitation [*R.A.M.*, v, p. 398]. When hydrocarbon oils heavier than benzene are used it is found that the higher the boiling point of the petroleum product, the greater the stability of its solution in creosote.

As the miscibility of hydrocarbon oils and creosote depends not only on the boiling point of the fractions, but also on their chemical composition, various mixtures of Russian petroleum product were prepared and the percentages of tarry precipitation determined in each case. It was found that purely naphthalenic petroleums, as well as hydrocarbon oils of the CH_4 series, yield the largest quantity of tarry precipitate on being mixed with creosote, while the smallest amount was given by naphtheno-aromatic petroleums. Hence the best petroleums for timber preservation are those consisting largely of aromatic and naphthenic hydrocarbons and containing no hydrocarbons of the CH_4 series. The presence in petroleum of a large quantity of aromatic compounds and of tars contributes to the stability of its mixtures with creosote, whereas a large content of CH_4 hydrocarbons and of naphthenes without aromatic compounds, and with only a small quantity of tar, leads to tarry precipitation. Timber is permeated by these mixtures in autoclaves at 90° to 100° C. at a pressure of 10 atmospheres.

Different kinds of wood are permeated at varying rates—the pine, for instance, twice as easily as the oak. On the whole, Russian heavy oils are well adapted to admixture with creosote for timber preservation, giving no more than 1·5 per cent. tarry precipitation.

MACLEAN (J. D.). **Absorption of wood preservatives should be based on the dimensions of the timber.**—*Proc. Amer. Wood Preservers' Assoc., 1929*, pp. 129–141, 1 diag., 1 graph, 1929.

The present specifications for the preservative treatment of wood are stated to give insufficient attention to the variability in results occurring when timbers of different lengths and different cross-section dimensions are treated according to directions. Absorption by volume of timber (pounds per cu. ft.) has been found the most satisfactory and convenient method of specifying treatment, provided it is based on a consideration of the ratio of surface area to volume. The author has calculated and gives tables for the amounts by which volumetric absorptions in various sizes of timber should be increased or decreased to give a treatment equivalent to that obtained with a given absorption in a 7 in. by 9 in. by 8 ft. timber. This method is applicable primarily to heartwood timbers, a consideration of the ratio of surface area to volume being superfluous in the case of sapwood, or in open, porous timbers admitting of complete penetration.

LINFORD (M. B.). **Pea diseases in the United States in 1928.**—*Plant Disease Reporter, Supplement* 67, 14 pp., 1929.

Notes are given on the diseases of peas observed in 15 States (in 12 of which a comprehensive survey was made) during the summer of 1928. Bacterial blight (*Bacterium* [*Pseudomonas*] *pisi*) [*R.A.M.*, v, p. 591 *et passim*] was the only disease found in every State inspected. Since the causal organism is known to be carried on the seed, the prevalence of the disease in the seed-producing areas of Idaho and Montana is regarded as significant.

Root rot (*Aphanomyces euteiches*) [ibid., vii, p. 354] was more widespread and abundant than any other disease during the period covered by the investigation, occurring in 40·6 per cent. of all the fields examined. In Maryland it was frequently associated with *Mycosphaerella* blight (*M. pinodes*) [ibid., vii, p. 611], the latter being more important and causing losses up to 35 per cent. in fields where cultural practices were neglected. Hitherto root rot has not assumed a serious character in the Rocky Mountain States generally, but the present survey indicates increasing prevalence and greater severity, especially in Utah and Montana. In fact, the evidence gleaned during the survey points to the continuous spread of this highly destructive disease, the damage from which is frequently overlooked or attributed to secondary causes.

The chlamydospores of the black rot fungus (*Thielavia basicola*) were found in large numbers on a few plants at Rexburg, Idaho, this being the first instance of its occurrence on peas in the writer's experience [cf. ibid., vi, p. 389].

Previous to this survey, *Fusarium* wilt of peas (*F. orthoceras* var. *pisi*) [ibid., viii, p. 215] had been reported only from Wisconsin, Michigan, and Indiana, but it is now known to occur also in Mary-

land, Pennsylvania, Ohio, Illinois, Idaho, Montana, and possibly California. Particular importance attaches to the detection of wilt in Idaho and Montana, whence the bulk of the seed used for the canning crop is procured. The opportunities for the dissemination of the disease in these States are exceptional, owing to the practice of irrigation and to the use of pea-vine straw as fodder and bedding for live-stock.

SEVERIN (H. H. P.). **Additional host plants of curly top.**—*Hilgardia*, iii, 20, pp. 596–629, 4 pl., 25 figs., 1929.

In this paper additional host plants of curly top disease of beets in the families Solanaceae, Cruciferae, Umbelliferae, Malvaceae, Linaceae, Boraginaceae, and Valerianaceae are enumerated [*R.A.M.*, viii, p. 83]. Natural infection was observed on eight economic plants in California and artificial inoculation experiments gave positive results on 25. The symptoms of the disease on the different hosts are described.

SIDERIS (C. P.). **The effect of the H-ion concentration of the culture solution on the behaviour of Fusarium cromyophthoron and Allium cepa and the development of pink-root disease symptoms.**—*Phytopath.*, xix, 3, pp. 233–268, 4 figs., 2 diags., 1 graph, 1929.

The growth of *Fusarium cromyophthoron*, the commonest species associated with pink-root disease of onions in California [*R.A.M.*, iv, p. 234], is appreciably influenced by the reaction of the culture medium, the total sugar content, and the age of the culture. The best development occurred at about P_H 6, but growth took place over a range of hydrogen-ion concentrations from P_H 3 to 7·5. The initial P_H value of the medium was changed in the majority of cultures, those having a reaction as near as possible to the isometabolic point of the principal nutrient substance of the culture being least affected. The consumption of dextrose was considerably less at P_H values below 4, which is believed to be the isometabolic point for dextrose. After the fungus has absorbed all the available sugar of the culture medium, its mycelium undergoes autolysis. During this stage the reaction becomes decidedly alkaline owing to the release of ammonia from the hydrolysed proteins of the fungus.

Both in water and soil cultures onion plants grow best between P_H 5·5 and 6·5, and they also change the initial reaction of the culture solution. High concentrations of H- or OH-ions were found to be toxic, especially the latter. The pathogenicity of *F. cromyophthoron*, measured by the death rate it causes, is higher at P_H values above 6·5, though lessened acidity inhibits the development of the pink colour on the roots. The higher death rate of roots grown in cultures between P_H 6·5 and 8 is attributed to the toxicity of high concentrations of OH-ions to the host tissues, with consequent lowering of their resistance. In solutions more acid than P_H 6·5 the fungus may infect naturally weakened roots, but it is incapable of wholesale invasion of the roots and destruction of the plants.

RODIGIN (M. N.). Заметка о **Gloeosporium** и **Macrophoma** на Тыквенных. [Note on *Gloeosporium* and *Macrophoma* on Cucurbitaceae.]—*Morbi Plantarum*, Leningrad, xvii, 3–4, pp. 153–154, 1928. [Received June, 1929.]

The author states that in 1928, when working at the Phytopathological Station of Detskoye Selo [near Leningrad], he observed the formation in the great majority of his cultures on sterilized peas of *Gloeosporium* [*Colletotrichum*] *lagenarium* from cucurbits of very numerous, dark, sclerotium-like bodies, closely resembling those described by Sheldon in 1904 (*W. Virginia Agric. Exper. Stat. Bull.* 94, p. 127, 1904). These bodies have a cortex consisting of cutinized cells, and a central cavity filled with a dense weft of radially disposed hyphae abstricting at their ends stylospores identical in shape and size with the conidia produced in acervuli. The stylospores readily germinated on a gelatine medium, and the cultures thus raised were used successfully to infect watermelons (*Citrullus vulgaris*) and produced the typical *Gloeosporium* form. He considers that these observations establish the fact that a pycnidial stage, which on the ground of the shape and size of the spores must be referred to the genus *Macrophoma*, enters into the life-cycle of *C. lagenarium*, and suggests for it the name *M. sheldonii.* The pycnidia are spherical or applanate, dark brown, indistinctly papillate, and measure 250 to 400 by 220 to 300 μ. The stylospores are cylindrical-ovate, with thickened walls, continuous, hyaline (but pinkish in mass), and measure 10 to 18 by 5 to 6 μ. A Latin diagnosis of the species is given.

RODIGIN (M. N.). К биологии **Gloeosporium lagenarium** (**Pass.**) **Sacc. et Roum.** [Contribution to the biology of *Gloeosporium lagenarium* (Pass.) Sacc. et Roum.]—*Morbi Plantarum*, Leningrad, xvii, 3–4, pp. 118–129, 1928. [Received June, 1929.]

After a brief reference to his paper on the *Macrophoma* stage of *Gloeosporium* [*Colletotrichum*] *lagenarium* [see preceding abstract], and to the work of previous investigators, the author gives some details of experiments conducted from 1926 to 1928, inclusive, on the growth of this fungus on various natural and synthetic cultural media, and its adaptation to certain substrata. The results showed that for growth and fructification the fungus requires acid media containing carbon, nitrogen, potassium, and phosphorus, while its requirements in sulphur are very small. The most suitable acid was citric acid. The best sources of carbon were maltose and saccharose, and of nitrogen, casein and peptone. Compounds of chlorine acted unfavourably on the development of the fungus. The growth was poor on cellulose, starch, potato, and beans, but luxuriant on apple, *Melilotus* stems, white bread, and peas.

In germinating, the spores produce several germ-tubes with appressoria borne either terminally or in the angles of the branches; the formation of appressoria is apparently dependent on an abundant supply of oxygen and a mechanical irritation of the tips of the growing hyphae. In liquid and solid synthetic media containing sources of carbon and nitrogen there is a fairly abundant production of sclerotia, which are considerably larger and of a

looser consistency than those that develop on natural substrata. It is believed that these sclerotia ensure the overwintering of the fungus in nature.

The experiments indicated that the complete life-cycle of *G. lagenarium* is sclerotium-pycnidium-acervulus-sclerotium.

RODIGIN (M. N.). О малоизвестном грибке **Fusarium reticulatum Mont.** [Note on a little-known fungus, *Fusarium reticulatum* Mont.]—*Morbi Plantarum*, Leningrad, xvii, 3–4, pp. 154–156, 1928. [Received June, 1929.]

Investigation of a fairly severe outbreak of wilt of melons (*Cucumis melo*) and watermelons (*Citrullus vulgaris*) in two localities of the government of Astrakhan in 1928 showed that the diseased plants suffered from a root rot caused by a species of *Fusarium* which was identified as *F. reticulatum* Mont., this being stated to be the first record of the fungus in the region in question. The main symptoms of the disease were a white, downy efflorescence of mycelium surrounding the collar of affected plants, and a yellowing of the leaves which finally rolled up and dried; in many cases the vines broke away at the collar. The same year the fungus was also found in another district of Astrakhan attacking the vines, chiefly of melons, on which it formed an abundant aerial mycelium, while the roots were for the most part spared. In pure cultures on gelatine media the fungus formed white, downy colonies. The conidia, both in nature and in culture, were falcate, tapering at both ends, with 1 to 3 septa, and measured 18 to 28 by 2·8 to 3 μ.

The other two species of *Fusarium* so far known to occur in Russia on Cucurbitaceae are stated to be *F. lagenarium* and *F. aurantiacum*.

KLEBAHN (H.). **Vergilbende junge Treibgurken, ein darauf gefundenes Cephalosporium und dessen Schlauchfrüchte.** [The yellow discoloration of young hothouse Cucumbers, a *Cephalosporium* found on them, and its perithecia.]—*Phytopath. Zeitschr.*, i, 1, pp. 31–44, 10 figs., 1929.

Since 1912 the author has observed a yellow discoloration and wilting of young hothouse cucumbers at Groningen (Holland) and in the vicinity of Hamburg. The frequent presence on the affected fruits of a species of *Cephalosporium*, with conidia measuring 10 to 13 μ in length by 3 to 4 μ broad, led to a series of inoculation experiments [details of which are given]. The results of these tests are inconclusive, for although infection was obtained on unwounded fruits in a large number of cases, the same symptoms occurred on cucumbers which were absolutely free from fungi. The exact rôle of the *Cephalosporium* in the causation of the disturbance cannot, therefore, be determined at present.

Cultures of the fungus on salep agar consistently developed a perfect stage, which in its turn reproduced the conidial form. The brown, thin-walled, papillate perithecia are approximately spherical, and measure 90 to 100 μ in diameter. The cylindrical to clavate asci measure 45 to 55 by 7 to 8 μ and contain eight elongated-oval ascospores, 11 to 13 by 3·5 to 4 μ. In some respects these characters

agree with those of the genera *Didymella* and *Mycosphaerella*, but the fungus under discussion differs from the former in the absence of filamentous paraphyses, from the latter in the development of the asci from the entire base of the perithecium instead of from a small central area, and from both genera in the loose hyphal network occupying the perithecia. The author accordingly proposes the establishment of a new genus, *Plectosphaerella*, with *P. cucumeris* as the type species. It was found impossible to identify the conidial stage with any of the species of *Cephalosporium* having conidia of similar dimensions, and it may be known, therefore, as *C. cucumeris*.

CARON (O.). **The Cucumber gall.**—*Twentieth Ann. Rept. Quebec Soc. Protect. Plants, 1927–1928*, pp. 69–70, 1928. [Received June, 1929.]

Cucumbers and melons in parts of Quebec were severely attacked in 1927 by a species of *Cladosporium*, probably *C. cucumerinum* [*R.A.M.*, vii, p. 6]. Inoculation experiments with the fungus produced positive results on both hosts. The organism makes very rapid growth in pure culture and evidently retains its viability for a considerable period (at least seven months). The lesions produced on melons are slightly larger than those developing on infected cucumbers, and diseased fruit fails to reach maturity.

LANZA (MIRANDA). **Lo svernamento della Peronospora dello Spinacio.** [The overwintering of *Peronospora* on Spinach.] —*La Difesa delle Piante*, vi, 2, pp. 7–9, 1929.

After a brief reference to Laubert's and Eriksson's observations that the spinach mildew [*R.A.M.*, viii, p. 218] does not form oospores, this being one of the reasons for proposing to separate it, under the name *Peronospora spinaciae*, from *P. effusa* which parasitizes many species of the Chenopodiaceae, the author reports that field observations during the winter of 1928–9 in Italy have definitely shown, in confirmation of Magnus's statement, that the mycelium of the spinach mildew lives through the winter in the tissues of the host leaves. In the material studied the hyphae were seen passing through the lacunar tissue and invading the palisade cells by means of haustoria. The spinach plants on which the mildew overwintered had been protected, during the severe winter frosts, by covering them with a layer of dry leaves or other plant débris, or even simply by a cover of snow. When the leaves from these plants were put under favourable conditions of temperature and humidity in the laboratory, the mycelium produced conidiophores. Oospores were not observed.

FAËS (H.). **La lutte contre les parasites de la Vigne et les traitements obligatoires en Suisse.** [The control of the parasites of the Vine and obligatory treatments in Switzerland.]—*Rev. de Vitic.*, lxx, 1812, pp. 185–189; 1813, pp. 203–206; 1814, pp. 217–221, 1929.

In this review of the legislative measures that have been taken in Switzerland to ensure obligatory and effective control of the parasites of the vine, the only disease of fungal origin mentioned

is mildew [*Plasmopara viticola*]. The laws regulating the control of this disease have been enacted by each Canton individually; they are based on much the same general recommendations, but differ in some details. Thus, in the Canton of Vaud, an order dated 27th January, 1925, enacts that the first application of an efficient cupric fungicide must be completed by the 10th of June each year. Local municipal authorities may, however, advance this date if necessary, and are also entrusted with the duty of fixing the number of subsequent treatments and the latest dates at which they shall be completed. In the Canton of Neuchatel the minimum number of treatments is fixed at five by an order of 8th May, 1928, while six applications are recommended in warm and moist seasons. The first treatment is to be completed on or before the 21st May each year, and a time schedule for the following applications is outlined.

SALMON (E. S.) & WARE (W. M.). **Reports from the Mycological Department.**—*Journ. South-Eastern Agric. Coll., Wye, Kent*, xxv, pp. 142–146, 1928.

The following references, in addition to those already noticed from other sources, occur in this report. Hollyhocks [*Althaea*] and loganberries [*Rubus loganobaccus*] were attacked by crown gall [*Bacterium tumefaciens*]; broccoli by *Gloeosporium concentricum*; sugar beets by *Rhizoctonia crocorum*; Midlothian seed potatoes by sprain of the 'kringerigheid' type [*R.A.M.*, v, p. 572]; peaches by *Cladosporium carpophilum*; wheat by *Ophiobolus cariceti* [*O. graminis*: ibid., viii, p. 421]; and parsnips by *Plasmopara nivea*. A new disease of hops, possibly of the virus group, has been observed on Fuggles and certain seedling varieties in Kent. It is known as 'split leaf' [see next abstract] and is characterized by the development of irregularly shaped holes in the leaves.

OGILVIE (L.). **Economic mycology.**—*Ann. Rept. Agric. and Hort. Res. Stat., Long Ashton, Bristol, for 1928*, pp. 188–194, [1929.]

The following items, *inter alia*, are of interest in this report. Good control of American gooseberry mildew [*Sphaerotheca mors-uvae*] has been obtained by the early application of sulphur dusts [*R.A.M.*, vii, p. 648], and this mode of treatment is now becoming general in large plantations. Heavy losses were caused by the disease in gardens where treatment was neglected.

Hop downy mildew (*Pseudoperonospora humuli*) was reported from Worcestershire in early June, but there were no general outbreaks of the disease during the year, probably on account of the dry weather in early summer. Nettlehead [ibid., iv, p. 634] was prevalent in several gardens of the Hereford district, Fuggles being the variety chiefly affected. 'Split leaf', characterized by a crinkling and splitting of the leaf bases from the eighth or ninth shoot upwards, was also observed in the Hereford district. In Worcestershire a case of apparently infectious mosaic occurred on Fuggles.

Dwarf beans [*Phaseolus vulgaris*] in the vicinity of Evesham were extensively affected by a disease closely resembling the dry root rot caused by *Fusarium martii* var. *phaseoli* [ibid., v, pp. 462, 463, *et passim*]. The cortex of the main stem and tap roots shows reddish lesions, the plants are chlorotic and stunted, and the yield is reduced. A species of *Fusarium* nearly allied to the above-mentioned organism in cultural and morphological characters was isolated from the lesions and its pathogenicity proved.

Field peas in the same neighbourhood were attacked by a bacterial disease similar to that due to *Pseudomonas pisi* in the United States [ibid., vii, p. 214]. The stem bases, leaves, and pods show water soaked, later brown or black lesions which cause the premature death of the plants. The pathogenicity of the bacteria isolated from the diseased plants was established.

Greenhouse tomatoes in Somerset were severely infected by *Colletotrichum atramentarium* [ibid., iv, p. 70; vi, p. 61].

BEAUMONT (A.) & HODSON (W. E. H.). **Fifth Annual Report of the Seale-Hayne Agricultural College, Newton Abbot, Devon, for the year ending September 30th, 1928.**—41 pp., 1929.

This report, prepared on similar lines to those of previous years [*R.A.M.*, vii, p. 490], contains also a list of 233 fungous and physiological diseases recorded in Devon and Cornwall (including the Scilly Isles) during the period under review.

Several cases of internal rot of mangolds, caused by *Phoma betae* [ibid., vi, p. 529], were observed at the end of 1927. The roots appeared quite sound externally but the inner tissues were black and full of hyphae. Infection is believed to have started in small crevices on the outside of the roots.

American gooseberry mildew (*Sphaerotheca mors-uvae*) is becoming increasingly severe in the Tamar Valley, where it was generally distributed early in May. Perithecia were found in many gardens during the winter, a fact which emphasizes the value of 'tipping' the shoots at the end of the summer [ibid., viii, p. 390].

Gooseberries and black currants were heavily damaged by leaf spot (*Pseudopeziza ribis*) in east Devon, the attack occurring unusually early (end of May) [ibid., viii, pp. 153, 154]. Black currants growing in richly manured soil were less affected than bushes in a poorer field.

Canna lilies (*Canna indica*) near Kingsbridge were attacked by *Armillaria mellea* a few yards away from a lilac tree which had been killed by the fungus. White root rot (*Rosellinia necatrix*) was also very common, occurring on all kinds of fruit trees [ibid., vi, p. 560], arum [*Zantedeschia aethiopica*] roots, potato tubers, and narcissus bulbs in the Scilly Isles, and on narcissus and tulip bulbs in Cornwall.

Wheat bunt (*Tilletia tritici*) [*T. caries*] was completely controlled by formalin 1 in 320, 2·5 per cent. copper sulphate, or copper carbonate (2 oz. per bushel), the last-named treatment giving the best growth and the largest stand. This method has

the further advantage of enabling the treated seed-grain to be stored without injury.

PRESTON (N. C.). **Part I. Report of the Advisory Mycologist, April, 1928–March, 1929.**—*Rept. Advisory Dept. Harper Adams Agric. Coll., Newport, Salop*, iv, pp. 4–8, 1 fig., 1929.

During the period under review mangold and sugar beet seedlings in the western Midlands were extensively affected by blackleg, which was frequently found to be due to a scorching of the young roots through contact with a high concentration of soluble salts in the soil, especially where fertilizers are applied with the seed. Only in a few cases was *Phoma betae* found to be involved.

Downy mildew of swedes (*Peronospora parasitica*) occurred in an unusually severe form near Ludlow, probably owing to a succession of warm days followed by cold nights.

Good control of finger-and-toe disease [*Plasmodiophora brassicae*] on Ellam's Early cabbage was given by 'puddling in' plants with mercuric chloride at concentrations of 1 in 1,500 or 1 in 2,000, these strengths being equally effective with the 1 in 1,000 solution and less likely to cause an arrest of growth. The average weight per head of the treated and control plants, which were set in alternate rows 2 ft. apart, was 3¼ and ½ lb., respectively.

CHEAL (W. F.). **Report of the Biological Department, 1926, and the Mycological Department, 1927.**—*Rept. Agric. Inst. Kirton, 1927*, pp. 58–67, [? 1928. Received August, 1929.]

During 1926 winter beans [*Vicia faba*] in the vicinity of Kirton, Lincolnshire, were severely affected by chocolate leaf spot (*Bacillus lathyri*) [*R.A.M.*, vii, p. 214]; potatoes were seriously attacked by late blight (*Phytophthora infestans*), and early varieties on 'potato sick' soil by *Corticium solani*. In 1927 another attack of *P. infestans* occurred on potatoes about a fortnight later than in the previous year, but no serious infection of winter beans by *B. lathyri* was noted or reported. An outbreak of onion mildew (*Peronospora schleideni*), accompanied in one instance by *Sclerotium cepivorum*, did considerable damage. Mildew [*Podosphaera leucotricha*] and silver leaf (*Stereum purpureum*) of apples, and American gooseberry mildew (*Sphaerotheca mors-uvae*) were more prevalent than in the previous year. In both years the most serious disease of celery was late blight (*Septoria apii*) [ibid., vii, p. 760]; good control was given by five applications of Bordeaux mixture (8–8–100, with or without a spreader), but lime-sulphur with a spreader and a proprietary brand of Bordeaux mixture did not give satisfactory results, although nine applications of the latter were made.

Oversigt over Plantesygdomme. 162. Vintermaanederne og April, 1929. [Survey of plant diseases. 162. Winter months and April, 1929.]—*Statens plantepatologiske Forsøg*, 6 pp., 1 pl., 1 fig., 1929.

The following items of interest, *inter alia*, occur in the first section of this report (on cereal and vegetable diseases in Denmark), contributed by E. Gram. *Fusarium minimum* [*Calonectria graminicola*] decimated the rye crops, especially in

eastern Zealand. In one case the beneficial effects of dusting the seed-grain with tillantin C were very conspicuous. Pastures and lawns suffered from the attacks of *F. culmorum* and *C. graminicola*, rye grass [*Lolium perenne*] being chiefly affected.

In the section on fruit and flower diseases Miss Weber reports a severe leaf fall of azaleas due to *Septoria azaleae* [see below, p. 649], while the same host was attacked by a fungus (? *Ramularia* sp.) [*R.A.M.*, vii, p. 640] causing a brown discoloration of the stems. On cinerarias affected by wilting just prior to flowering were found *Fusarium* sp., *Pythium* sp., *Rhizoctonia* [*Corticium*] *solani*, and bacteria.

SIEMASZKO (W.). **Phytopathologische Beobachtungen in Polen.** [Phytopathological observations in Poland.]—*Centralbl. für Bakt.*, Ab. 2, lxxviii, 1–7, pp. 113–116, 1929.

The following items of interest, in addition to those already noticed from other sources, occur in this report, covering the period from 1923 to 1928, inclusive. Crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) was very prevalent in central Poland on crab-apples, and in places also on wild pears. The author states that he frequently observed this disease in Transcaucasia [where he previously resided] on pears, apricots, cherries, almonds, roses, *Diospyros kaki* and *D. lotus*, mulberries, *Eucalyptus* sp., and *Passiflora* sp. *Prunus divaricata* appears to be immune from *Bact. tumefaciens* both in Transcaucasia and Poland. Stored pears were attacked by *Phomopsis mali* [*Diaporthe perniciosa*].

The aecidial stage of *Puccinia opizii* Bub. was observed on head lettuce in Puławy in the summer of 1928. In the same district *Taphrina ulmi* caused heavy damage to elms in 1927, and *T. rhizophora* occurred on poplars.

Herpotrichia nigra [*R.A.M.*, v, pp. 197, 198, 525] was found on 20- to 30-year old spruce trees in the virgin forest of Bialowies, this being the first record of its occurrence in the plain. In the Polish Tatra mountains *H. nigra* has been observed on young spruce growth at an altitude of 900 to 950 m., while in the eastern Carpathians it occurs only in the alpine regions on *Pinus montana*, *Picea excelsa*, *Juniperus nana*, and *J. communis*. In these mountains the sparse development of *Neopeckia coulteri* [see above, p. 616] in association with *H. nigra* on *P. montana* was also observed.

Acer plantanoides suffers annually from the attacks of *Cercospora acerina* in the damp park of Skierniewice.

C. apii var. *carotae* [ibid., vi, p. 176; viii, p. 19] occurs every summer on fodder carrots in Lublin. This fungus is stated to differ in morphological characters from *C. apii*, having smaller conidiophores and conidia, and moreover, its pathogenicity is restricted to carrots. It is therefore regarded as a distinct species, which is named *C. carotae* (Pass.) Kaznowski & Siem.

Ceratophorum setosum [ibid., vii, p. 583] was found attacking the leaves, pods, and seeds of lupins in Lublin and Warsaw districts. The fungus occurs as an independent parasite or in company with *Fusarium* spp. In wet spring weather the seedlings are severely damaged, while similar conditions in the autumn

favour infection of the seed, which germinates poorly in consequence. The most susceptible species is *Lupinus albus*; *L. hirsutus*, *L. mutabilis*, and *L. polyphyllus* are less liable to infection, while *L. angustifolius* and *L. luteus* are resistant.

Valdensia heterodoxa [ibid., vii, p. 203] has been found in south and central Poland parasitizing the leaves of *Aspidium filix-foemina*, *Convallaria majalis*, *Polygonatum* sp. *Corylus avellana*, beech, oak (*Quercus sessiliflora* and *Q. pedunculata*), *Hieracium* (? *boreale*), *Hypericum* sp., *Rubus* sp., and *Vaccinium myrtillus*. Prof. Jaczewski informed the writer in correspondence that the last-named plant is also attacked by *V. heterodoxa* near Leningrad.

SMITH (F. E. V.). **Plant diseases in Jamaica in 1928. Report of the Government Microbiologist.**—*Ann. Rept. Dept. of Agric. Jamaica for the year ended 31st December, 1928*, pp. 17–20, 1929.

An examination of the records of Panama disease of bananas (*Fusarium cubense*) in Jamaica has shown that, while drought inhibits the manifestation of symptoms, there is an immediate increase of infection with the advent of the rains. The fresh attacks induced by an abnormally heavy rainfall may, however, take two to four months to become apparent. The total number of diseased plants eradicated in 1928 was 54,109 [*R.A.M.*, vii, p. 492]. It is stated on p. 2 of this report that 287 hybrids between the Gros Michel or Jamaica banana and other edible varieties which are immune from, or resistant to, Panama disease have been developed. Of these, some crosses of Gros Michel and Robusta are of great promise.

The yellow discoloration and premature death of coco-nut palms is very often associated with the presence of *Pestalozzia palmarum* [ibid., viii, p. 170] and *Diplodia* [ibid., vii, p. 717], but similar symptoms may occur in the absence of these organisms. The trouble is frequently confined to single trees surrounded by healthy ones. Severe cases are invariably associated with adverse soil conditions, occurring noticeably on heavy clays and dry 'bumps', especially where there are outcrops of rock.

A special investigation was carried out on the death in patches of logwood [*Haematoxylon campechianum*] trees in Westmorland from a disease originally studied by Earle about twenty years ago. The root systems of affected trees, which are found chiefly where there is a heavy clay subsoil near the surface, constantly revealed the presence of a mycelium with clamp-connexions, and in a few cases the fructifications of *Ganoderma lucidum* (which, it is stated, there is little doubt is the primary cause of the trouble) were also observed. Diseased trees wither and generally die rapidly.

Papaw trees on the Liguanea plain and elsewhere are affected, chiefly in the bearing stage, by a mottling of the terminal leaves as they emerge from the bud, accompanied by gradual reduction to the size of a pencil point. The larger leaves droop and eventually die, while the majority of adventitious buds on the lower part of the stem also succumb. The mottling of the leaves, coupled

with the absence of any organism in the tissues, suggests that the disease is due to a virus.

Rosellinia bunodes (and possibly other species of the same genus) are responsible for a disease known as black rot, which affects avocado pears, yams [*Dioscorea* spp.], cocoes [*Colocasia antiquorum*], ginger, and coffee, and to a lesser extent, bananas, oranges, &c. Inoculation experiments on sour orange [*Citrus bigaradia*] seedlings gave negative results, but coffee and grapefruit seedlings were killed within a month.

CUNNINGHAM (H. S.). **Report of Plant Pathologist.**—*Rept. Dept. of Agric., Bermuda, for the year 1928*, pp. 26–28, 1929.

This report (covering the period from 19th June to the close of 1928) contains, *inter alia*, the following items of interest. Black tip disease of banana (*Cercospora musarum*) [*Helminthosporium torulosum*: *R.A.M.*, vii, p. 731] was responsible for considerable losses in some plantations. The results of experiments in the control of the disease by dusting with copper-lime varied so widely that no definite conclusions as to the efficacy of the treatment could be reached.

All celery seed imported into Bermuda was, as usual, inspected for *Septoria* blight [*S. apii*: ibid., vii, p. 696], from which the French seed was found to be remarkably free.

Fig trees throughout the Colony were severely attacked by *Cerotelium* [*Kuehneola*] *fici* [ibid., viii, p. 257], frequently suffering almost complete defoliation. Good control may be obtained by the repeated use of sulphur dust.

McDONALD (J.). **Annual Report of the Mycologist for 1928.**—*Ann. Rept. Dept. of Agric. Kenya for the year ended 31st December, 1928*, pp. 187–197, 1 fig., 1929.

When numerous wheat varieties were artificially inoculated with stem rust (*Puccinia graminis*) obtained from ten different districts in Kenya, most of the varieties reacted consistently, but four were resistant to some of the rust collections and susceptible to others. Repeated experiments with these four proved conclusively that at least two distinct physiologic forms (designated K_1 and K_2) of the rust exist in Kenya. Kenya Governor wheat [*R.A.M.*, vii, p. 771] was highly resistant to one form, but moderately susceptible to the other. Form K_1 was found in seven of the ten districts and K_2 in the remainder, while at Nairobi K_1 was the form present towards the end of 1927 and K_2 that found in July, 1928.

At the beginning of the hot season of 1928, sisal [*Agave rigida* var. *sisalana*] was affected with a leaf injury, leaves which appeared sound before cutting arriving at the factory in an unhealthy condition. Large patches of tissue in the upper halves of the leaves turned purplish-brown and became completely bleached in a few hours. Some days later these areas blackened, and in many of them the fructifications of *Colletotrichum agaves* were noted [cf. ibid., vii, p. 766]. Laboratory tests showed that these symptoms could be reproduced by placing freshly cut leaves flat on a bare roadway in contact with the soil on a hot day; no injury occurred

when the leaves were raised an inch or so from the ground, although still kept horizontally and exposed to the sun, nor were they damaged when placed vertically with the butts on the ground and the tips together. It is concluded that the condition was brought about solely through the contact of the leaves with the heated soil on exceptionally hot days.

A second type of injury to the same host was reported in the cool season; the leaves, tied in bundles and left for a few hours in the plantation (often over-night) developed yellow, buff, or purplish depressions on both sides, green areas of normal tissue being visible in the affected patches. At the laboratories freshly cut sisal leaves were laid during cool weather flat on a roadway and a grass lawn, half of each batch being covered with sacking. The uncovered leaves remained unaffected during the five days that the experiment lasted, while slight symptoms developed on the others during the first night; in two and a half days all the covered leaves showed the same type of injury as that present on the plantation cuttings.

A third type of injury to sisal leaves was characterized by red, slightly sunken blotches on the young leaves, which were still almost vertical and attached to the plant. The evidence pointed to the hot afternoon sun as the chief agent of the trouble, but as this was confined to part of one estate it is thought that soil influences may have rendered the leaves susceptible.

A disease of barley, associated with a species of *Helminthosporium*, caused an appreciable loss of crop in two or three districts in Kenya in the latter part of the period under review.

Mosaic was reported on sugar-cane in the vicinity of North Lumbwa, Fort Fernan, and Central Kavirondo; only a small amount of cane was affected, and steps were taken in co-operation with the Administration and the settlers concerned to destroy the susceptible varieties.

DANA (B. F.). **Diseases of vegetable and field crops (other than cereals) in the United States in 1928.**—*Plant Disease Reporter, Supplement* 68, pp. 15–109, 1 map, 1929.

This report, compiled on similar lines to those of previous years [*R.A.M.*, viii, p. 22], contains, *inter alia*, the following items of interest. The incidence of psyllid yellows on Utah potato crops [ibid., vii, p. 463] was greatly reduced in 1928 as compared with 1927, the decrease in yield being estimated at only 7 as against 25 to 30 per cent. During 1928 the disease was also reported from California, where the symptoms were very similar to those described from Utah. Yellowing, rolling, and purpling of the leaves were quite conspicuous, growth was arrested, the internodes were shortened, and tuberization occurred freely at the nodes and rosetted apices. Infection evidently took place before the formation of the tubers, most of which were no larger than walnuts. Psyllid yellows was first observed in Colorado in 1926, causing a loss of two-thirds of the early crop in the Fruita district; the disease was not reported in fields above 6,000 ft.

Curly top of tomatoes, formerly known as western yellow blight or yellows [ibid., viii, p. 84], caused heavy losses in parts of New

Mexico, Arizona, southern Utah, and eastern Oregon. The prevalence of this disease appears to depend entirely on the presence of the beet leafhopper (*Eutettix tenella*), and hence the factors influencing the development of this agent of transmission are very important. In the Hunter and Magna districts of Utah, where the maximum infection observed in 1928 was 81 per cent., curly top is the most serious tomato disease.

Stem and root rot of beans (*Macrophomina phaseoli*) was reported from Georgia and Mississippi [ibid., vii, p. 226].

Pink root of onions (*Fusarium malli*) caused slight losses in a number of States and heavy damage for the first time in north-central Iowa. In California it was reported as general, but was attributed by Kendrick to a species of *Phoma*.

The most serious of the cucumber diseases reported during 1928 was mosaic, which occurred in 18 States and caused 10 and 15 per cent. loss in Kansas and New York, respectively. Mosaic completely destroyed 100 acres of muskmelons in the Imperial Valley of California. A wilt disease (possibly bacterial) of squash [*Cucurbita* sp.] was reported from Utah, where it caused an average of 56·2 per cent. infection in ten fields inspected. According to Linford, the disease is associated with the squash bug (*Anasa tristis*). The causal organism of this wilt (which is stated seriously to threaten the production of squashes in Utah) is believed to be distinct from *Bacillus tracheiphilus*.

The so-called 'yellows' or 'rabbit's ear' disease of lettuce, found by Kunkel (*Florists' Review*, lxii, p. 35, 1928) to be due to the virus responsible for aster yellows [ibid., viii, p. 19], caused 7 per cent. loss in New York, 35 per cent. in Pennsylvania, and was also reported from the Rio Grande Valley, Texas.

Downy mildew of hops (*Pseudoperonospora humuli*) was observed for the first time on a Bavarian hop farm in Otsego County, New York, where it is evidently of recent introduction.

A map is given showing the distribution of root rot of cotton (*Phymatotrichum omnivorum*) [ibid., viii, pp. 501, 502] in Texas.

Notes are also given on the diseases affecting many other crops, including tobacco, sugar-cane, and sugar beet, during the period under review.

[**Plant disease investigations at the Connecticut State Station.**] —*Connecticut Agric. Exper. Stat. Bull.* 298, pp. 122–125, 127, 1 fig., 1928. [Abs. in *Exper. Stat. Record,* lx, 8, p. 743, 1929.]

Mosaic of Cuthbert raspberries could not be controlled by roguing in the experiments conducted during the period under review [cf. *R.A.M.*, vii, pp. 36, 37, *et passim*].

Infection of tobacco plants with white pickle mosaic of cucumbers [ibid., viii, p. 352] is reported to have produced leaf mottling, but plate crystals were not found in the mottled leaves and infection tended to disappear in the new growth.

Young (P. A.) & Morris (H. E.). **Plant diseases in Montana in 1928.**—*Plant Disease Reporter, Supplement* 69, pp. 110–175, 1 pl., 8 maps, 1929. [Mimeographed.]

This report on a preliminary survey of the plant diseases of

Montana, based chiefly on field inspections made by the writers between 15th May and 1st October, 1928, includes 435 parasitic, 29 virus, and 34 non-parasitic diseases of 95 species and varieties of economically important plants in Montana. It is stated that a host index comprising 1,075 diseases of non-economic plants in the State has also been prepared and incorporated with the present list in a card index. The 1,573 parasites and diseases included in the latter are stated to occur on 831 species and varieties of plants.

Although this report refers primarily to 1928, all available data concerning previous reports have been assembled in order to present a comprehensive survey, the first of its kind for Montana.

NEWTON (G. A.). **Department of Plant Pathology.**—*Western Washington Agric. Exper. Stat. Bull.* 10-W, pp. 21–23, 1928. [Abs. in *Exper. Stat. Record*, lx, 8, p. 746, 1929.]

Preliminary investigations of slime rot of lettuce [*R.A.M.*, vi, p. 338] indicate that the bacteria associated with this disease may be secondary to injury by *Botrytis cinerea* and tipburn [ibid., vii, pp. 142, 422]. Inoculation experiments with bacterial suspensions from the slimy heads gave inconclusive results.

The basal rot of narcissus caused by *Fusarium* sp. [ibid., viii, p. 42] did not yield to treatment with hot water and organic mercury compounds.

Bacterial leaf blight of lilac (*Bacterium* [*Pseudomonas*] *syringae*) [ibid., vii, p. 715], bacterial canker of tomatoes (*Aplanobacter michiganense*) [ibid., viii, p. 356], and hyacinth yellows (*Bact.* [*P.*] *hyacinthi*) [ibid., vii, p. 592] were reported for the first time in Washington.

Twenty-sixth Annual Report of the Bureau of Agriculture, Philippine Islands, for the fiscal year ending December 31, 1927.—81 pp., 1929.

The section of this report dealing with plant diseases (pp. 21–24) contains the following references of phytopathological interest other than those already noticed from different sources. Bunchy top and heart rot of abaca [*Musa textilis*: *R.A.M.*, vii, p. 143] are now believed to be different stages of the same disease, the primary cause of which is a filterable virus; the heart rot represents the final phase. This view is supported by the positive results of inoculation experiments with the aphid vector, *Pentalonia nigronervosa*, which also appears to be responsible for the spread of bunchy top of bananas in the Philippines [cf. ibid., viii, p. 184]: this disease is particularly severe on the Sabá and Latundan varieties.

Sclerotial stem rot (*Sclerotium oryzae*) [ibid., viii, p. 263] was found in field surveys to be the most serious disease of rice, especially during the period under review, when climatic conditions greatly conduced to its development.

Investigations were conducted on a bacterial disease of tobacco apparently identical with wildfire [*Bacterium tabacum*], and on a green spot of Sumatra wrapper at Sarunayan, Cotabato Province, Mindanao, the causal organism of which has not yet been determined.

FAWCETT (G. L.). **Departamento de Botánica y Patologia Vegetal.** [Department of Botany and Plant Pathology.]—*Rev. Indust. y Agric. de Tucumán*, xix, 9–10, pp. 254–259, 1 fig., 1929.

Notes are given on the occurrence of pineapple disease (*Thielaviopsis paradoxa*) and mosaic of sugar-cane in Tucumán during 1928, the former being new to the province [*R.A.M.*, viii, p. 467]. The P.O.J. 2714 and 2725 varieties are the only ones, within the writer's experience, to contract a purely temporary form of mosaic [ibid., vii, p. 743].

Heavy damage was caused by vine anthracnose (*Gloeosporium ampelophagum*) [ibid., iv, p. 15 *et passim*], the grape crop being a total failure over almost the entire province.

JACQUET (J. H.). **Les balais de sorcière du Cacaoyer et les moyens de les éviter.** [Witches' broom of Cacao and the means of avoiding it.]—*Agron. Colon.*, xviii, 137, pp. 129–133, 1929.

After referring to the fact that owing to the ravages of witches' broom (*Marasmius perniciosus*) [*R.A.M.*, viii, p. 488] the annual cacao crop in Ecuador has been reduced by 60 per cent., the author puts forward the view that infection largely depends upon the physiological weakness of the trees, and in support of this states that in 1927 he saw affected cacao in Surinam which was growing in lowlands resembling the polders of Holland [ibid., vii, p. 509]. Here a thin layer of fertile soil was separated from the sandy subsoil by a bed of clay 80 cm. thick, with the result that the roots remained near the surface and the trees were badly nourished throughout the year, being particularly liable to fungous attack in the wet season when the soil became waterlogged. Cacao growing wild in the interior, though attacked by *M. perniciosus*, is able to resist the fungus successfully without suffering any loss in yield, while in certain highland regions in Surinam and French Guiana, where good methods of cultivation are practised and the trees are mostly without shade, the disease is unknown.

GUYOT (L.). **Le piétin des céréales.** [Foot rot of cereals.]—*Prog. Agric. et Vitic.*, xci, 18, pp. 435–438, 1929.

Foot rot of cereals, and especially of wheat (*Ophiobolus graminis*, *Leptosphaeria herpotrichoides*, and *Fusarium culmorum*) is now under investigation in France by a special commission, of which the writer is secretary. At a meeting recently held in Paris it was stated that the disease seems equally prevalent on stony, dry soil and moist and sloping ground, but is less so on clay soils, where growth is retarded; wheat is most susceptible on hot, fertile soils. The presence of healthy plants in diseased stands suggests possibilities of individual resistance. The adverse effects of moist conditions of the air near ground level caused by weeds were noted. The special susceptibility of wheat sown early in autumn was attributed either to successive infections resulting from the wheat being too long in the ground or to the too rapid growth of early seedlings. Attention was drawn to the fact that weak tillering varieties appear to be the most resistant, while a correlation was observed to exist between resistance to cold and to foot rots. Wet

winters often conduce to the disease, but wheat damaged by frost is usually little attacked by foot rot. In the vicinity of Paris damp spring weather favours the development of *L. herpotrichoides.*

Observations were reported which confirm the view that lesions on the leaves of cereals increase resistance to foot rot; in one experimental plot where the wheat was grazed by passing sheep, infection was reduced from 38·5 to 25 per cent., this being attributed to the desiccation of the outer sheaths after the leaf injury, preventing the penetration of the fungus.

Wheat sown after crimson clover [*Trifolium incarnatum*] seems to be particularly liable to infection, this being apparently related to a reduction in the available food material in the soil.

The date at which manure is applied appears to affect the seriousness of the attack; the practice is becoming general of applying nitrate of soda in the autumn and again when vegetation is renewed in the spring, in order to ensure rapid germination and good growth in the early stages, which combined with complete cessation of growth in winter puts the wheat into the best condition for resistance.

The date of the application of the sulphuric acid treatment [*R.A.M.*, vi, p. 403] also appears greatly to affect its efficacy. It was stated that an application of 10 per cent. iron sulphate solution given after 1st April reduced infection from 90 per cent. in the untreated, to 33 per cent. in the treated plot.

[This paper is also printed in *Journ. d'Agric. Prat.*, xciii, 22, pp. 436–438, 1929.]

BENSAUDE (MATHILDE). **Notes on Wheat diseases in Portugal.**— Reprinted from *Bol. Soc. Broteriana*, vi (Ser. ii), 41 pp., 1 map, 1929.

The following parasitic fungi were detected on specimens of wheat received during June, 1928, from over 100 localities in different parts of Portugal: *Tilletia tritici* [*T. caries*], *T. levis* [*T. foetens*], *Ustilago tritici, Puccinia graminis, P. triticina, P. glumarum, Septoria tritici, S. nodorum, Ophiobolus graminis*, and *Fusarium culmorum*, while brown neck, a physiological disease characterized by the production of brown streaks on glumes, awns, rachides, and culms, was also prevalent, especially on the Ribiero variety [*R.A.M.*, vii, p. 314]. This is believed to be the first report of brown neck and the three last-named fungi in Portugal. Notes are given on the distribution and severity of the various diseases in each district of Portugal.

Seed treatment for the control of bunt is stated to be widely practised, immersion in a weak solution of copper sulphate (1 to 1·5 per cent.) or strong vinegar being the usual method and apparently a satisfactory one.

Loose smut is widespread, and is evidently liable to confusion with bunt in many localities. The durum wheats are reported to be resistant to *U. tritici*.

Uredo- and teleutospores of *P. graminis* were found on specimens examined in June from twelve districts [which are listed], indicating the ubiquity of stem rust in Portugal. The common barberry, however, the alternate host of the fungus, occurs only

north of Coimbra. It is not known, therefore, whether the epidemics observed during the spring in the south start near the barberry bushes in the north and are disseminated by wind-borne uredospores, or whether the rust passes the summer and winter in the uredo stage on wheat and wild grasses in southern Portugal [cf. ibid., viii, p. 489]. *P. triticina*, the least injurious of the three rusts, probably occurs throughout the country. *P. glumarum* causes very serious epidemics, culminating during April and May in the fields inspected by the writer in 1928.

O. graminis was also responsible for heavy damage during 1928, when an extremely cold, wet winter and spring favoured its development. The wheat and barley crops showed the symptoms of foot rot (erroneously attributed to malnutrition associated with the sudden heat-wave in June and July) some time before the onset of the hot weather. The fungus was observed to occur on two wild grasses in addition to the cultivated hosts, namely *Phalaris brachystachys* and *Lolium temulentum*. Perithecia were not found on these plants.

A strain of *F. culmorum* [ibid., vii, p. 710; viii, p. 497] has repeatedly been isolated during the last two years from wheat plants with diseased roots, discoloured crowns, short internodes, and 'deaf' ears.

S. tritici [ibid., ii, p. 212; vi, p. 543] was found in abundance only on plants previously weakened by *O. graminis*, with the exception of two varieties of *Triticum pyramidale*, which proved highly susceptible to this fungus.

S. nodorum [ibid., vii, p. 771] was particularly severe on wheat crops cultivated in poor, barren soils, where it caused the death of young tillers, dwarfing of culms and ears, and discoloration of nodes, chaff, and awns.

BURTON (G. H.). **Report of Plant Breeder.**—*Ann. Rept. Dept. of Agric. Kenya for the year ended 31st December, 1928*, pp. 198–254, 5 figs., 1 plan, 1929.

At the Scott Agricultural Laboratories Plant Breeding Station, Kenya, where wheat varieties are being bred for resistance to stem rust [*Puccinia graminis*], 28 families of hybrid wheats were sown during the period under review, consisting of 333 cultures of some 50,000 hybrid grains. Some 40 pure line wheats were tested for yield and resistance to stem rust with the Kenya Governor variety [see above, p. 632] as the control. At the Njoro Plant Breeding Station, where wheats are being bred for resistance to *P. graminis* and yellow rust [*P. glumarum*: *R.A.M.*, vii, p. 771], 368 cultures of 38 hybrid families were tested in the cage and a large number in yield trial plots. Many of these are highly resistant to stem rust, and some to both stem and yellow rust; it may prove difficult to improve on some of them except as regards the quality of the grain.

Seventeen selected strains of the new Njoro varieties were tried at Mau Summit as a more severe test for resistance to yellow rust than they could undergo at Njoro. Two years' experience has shown that both stem and yellow rust can be very destructive at the higher altitudes, with the result that the Equator variety,

though immune from the latter, is no longer a safe wheat to grow at these elevations, on account of its susceptibility to stem rust. Wheats will, accordingly, continue to be bred at Njoro for resistance to both rusts, and strains whose resistance to *P. glumarum* appears to be doubtful will be grown at Mau Summit for a thorough test.

The author considers that the new variety B. 286 can be grown in all districts of Kenya without fear of serious loss from stem rust; it results from a cross made in 1922 between the wheats numbered B. 96 A (L. 19) and B. 102, is early maturing, has strong straw and close chaff, but is probably not a heavy yielder.

Maize in Trans Nzoia was seriously affected by white blight [*Helminthosporium turcicum*]; under the local conditions the Hickory King variety was not resistant, but Natal White Horse Tooth was so, though not completely [ibid., v, p. 292].

MARSH (R. W.). **Report on bunt prevention trials, 1928.**—*Ann. Rept. Agric. and Hort. Res. Stat., Long Ashton, Bristol, for 1928*, pp. 138–139, [1929].

As in previous years, practically complete control of bunt [*Tilletia caries* and *T. foetens*] on Little Joss wheat grown from artificially infected seed was obtained at Long Ashton by treatment with 2·5 per cent. copper sulphate solution, 1 in 320 formalin solution, and copper carbonate dust (2 oz. per bushel) [*R.A.M.*, vii, p. 625]. The incidence of infection in two control plots was 27·01 and 23·65 per cent., respectively. Under local conditions the efficacy of all the treatments was approximately equal, and none appreciably affected the density of the stand.

ROSAM. **Verbesserte Trockenbeize des Saatgutes.** [Improved dusting of seed-grain.]—*Deutsche Landw. Presse*, lvi, 16, p. 229, 2 figs., 1929.

Good results have been obtained by the writer in Czecho-Slovakia by cleaning cereal seed-grain with sharp sand, grit, gravel, or fine slag previous to disinfection by dusts. The seed-grain is mixed in the drum of the dusting apparatus with one of these substances in the ratio of 4 or 2 of grain to 1 of sand, &c., according to the severity of infection and, after winnowing out the sand, is treated in the ordinary way. The spores are removed from the surface of the seed-grain by contact with the sharp edges of the admixed substance, so that in the subsequent disinfection process a smaller quantity of the fungicide can be used. The dust also penetrates more readily through the fine scratches on the surface of the cleaned seed-grain and destroys any embedded spores.

HAUPTFLEISCH (K.). **Über den Einfluss von Saatbeizmitteln auf das Auftreten von Marssonina graminicola an der Gerste.** [On the influence of seed disinfectants on the occurrence of *Marssonina graminicola* on Barley.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, ix, 4, pp. 27–28, 1929.

In a series of experiments [the results of which are tabulated] on the control of leaf blotch of barley (*Marssonina graminicola*) [*Rhynchosporium secalis*: *R.A.M.*, viii, p. 371] by seed treatment with various liquid fungicides and dusts, germisan and G. 506

(30 minutes' immersion in 0·125 per cent. solutions) proved most efficacious, reducing the incidence of infection from 19·93 to 1·66 and 1·67 per cent., respectively. The germisan short disinfection process [ibid., viii, p. 229] and 30 minutes' immersion in 0·25 per cent. uspulun-universal or 0·125 per cent. U. 440 also gave good control (under 3 per cent. infection), but the dusts, especially abavit B, proved unsatisfactory. As *R. secalis* is not known to be carried by the seed, it is thought that infection must have come from the soil in the fields in which these experiments were carried out.

EICHINGER. **Beizversuche mit Hafer-Tillantin.** [Steeping experiments with hafertillantin.]—*Illus. Landw. Zeit.*, xlix, 15, p. 167, 1 fig., 1929.

In the Niederlausitz [Saxony], where oats are extensively cultivated, loose smut [*Ustilago avenae*] causes heavy damage (up to over 30 per cent.) even in fields planted with absolutely healthy seed. Complete control of this disease was obtained in 1928 by dusting with hafertillantin [*R.A.M.*, vii, p. 711], while the total number of smutted panicles in four separate strains of oats, grown in plots of 24 sq. m. each, was 552. No injury to germination was observed either in the field or in laboratory tests. The action of hafertillantin is due to the liberation of gases which kill the smut spores between the glumes, and it is therefore essential to cover the treated seed-grain heaps with sacking for a considerable period in order to prevent the dispersion of these.

WOGLUM (R. S.). **Brown rot, Bordeaux and fumigation.**—*California Citrograph*, xiv, 5, p. 180, 1929.

Brown rot of citrus [*Phytophthora citrophthora*] became prevalent in California following rains early in December, 1928. Experiments by Fawcett showed that Bordeaux mixture 3–3–50 applied in autumn before the onset of wet weather gave effective control. The ground, trunk, and lower branches, to a height of about 3 ft., should be well covered with the spray, 2 to 5 galls. of mixture being used per tree. Subsequent fumigation of sprayed trees with hydrocyanic acid gas is liable to injure the fruit, the period of danger lasting about 6 months if the spray has been applied lightly and only to the lower branches, though severe damage has been noted even when a whole year intervened on trees completely covered with strong Bordeaux mixture. Trees of which the trunk or roots have been severely scraped and painted with strong Bordeaux paste may remain very susceptible to injury by fumigation for many months. Following the ordinary spraying of foliage and fruit, however, such injury is usually confined to defoliation accompanied by fruit burn or drop.

FAWCETT (H. S.). **Citrus psorosis (scaly bark).**—*California Citrograph*, xiv, 6, pp. 235, 238, 5 figs., 1929.

After briefly describing the symptoms of scaly bark or psorosis of citrus trees [*R.A.M.*, vii, p. 508] the author states that cure is possible in the first, and sometimes in the second, stage (characterized by a small pustular patch of bark and a larger scaly area, respectively), while provided that the tree is not too far gone, the

disease may be arrested even in the third stage, when much of the surface of the trunk is affected and the wood somewhat stained.

The disease appears to be active only in very old bark. In the early stages of development it spreads in the outer layers of the bark, but only indirectly affects the wood. Treatment should aim at removing the outer layers and stimulating the formation of new bark underneath. The safest method of doing this consists in scraping away the bark 6 to 8 in. beyond the visible limit of the disease, and allowing some of the underlying bark tissue to dry up and be pushed off by the stimulated activities of the cambium. If the bark is thick the scraping should be made deep enough to remove almost all the green layer under the outer one, otherwise it should just expose the former. No wax or water-tight material should be applied, and most of the small, diseased limbs should be cut out.

In dry weather cure may usually be effected without recourse to a disinfectant, but as a precaution the scraped area should ordinarily be disinfected within a few hours of the operation, preferably with a 1 per cent. solution of potassium permanganate; the scraping and pruning implements should also be disinfected.

Successful treatments have been made at all seasons, but under Californian conditions bark treated in the late spring or summer recovers most rapidly.

RATLIFFE (G. T.). **A prolonged saprophytic stage of the Cotton root-rot fungus.**—*U.S. Dept. of Agric. Circ.* 67, 8 pp., 5 figs., 1929.

Observations made in 1927 in Texas and Arizona indicated that the cotton root rot fungus (*Phymatotrichum omnivorum*) [*R.A.M.*, viii, p. 308] may remain in an infectious state in the soil during a period of several years on the roots of dead host plants. This explains why a clean fallow system, even when strictly maintained for three years, fails to ensure a satisfactory reduction of root rot on sites where deep-seated infection occurs.

NOLLA (J. A. B.). **Acrostalagmus aphidum Oud. and aphid control.**—*Journ. Dept. Agric. Porto Rico*, xiii, 1, pp. 59–72, 2 pl., 1929.

This is a brief account of the author's investigation of the fungus which was recorded by J. R. Johnston, under the name *Acrostalagmus albus* Preuss, as parasitizing aphids in Porto Rico, and which has since been identified as *A. aphidum* Oud. [*R.A.M.*, viii, p. 380], although there appears to be a wider range of length and width of the spores in the Porto Rican form than that given in the diagnosis in Saccardo's Sylloge [which is reproduced]. Cultural studies showed that the fungus may be successfully grown in pure culture on natural or artificial media, development being best at hydrogen-ion concentrations of P_H 6·93 to 7·93. The germination of the spores was stimulated in sucrose and glucose solutions, and they were shown to be very sensitive to desiccation, as they retained their germinability for only five days in the absence of moisture.

Inoculation experiments [details of which are given] indicated that *A. aphidum* attacks aphids found on 17 species of plants, of which nine are new records. The susceptible aphids comprise five different genera (three of which were already known to be susceptible). Besides these, the eggplant lace-bug (*Corythaica monacha*) has also been reported in Porto Rico to be attacked. The fungus was successfully used for the control of the eggplant aphid, *Rhopalosiphum* [*Myzus*] *persicae*, by a method which is briefly described, and it is believed that the same method may also be used with success in field control of the aphids of other vegetables.

COUCH (J. N.). **A monograph of Septobasidium. Part I. Jamaican species.**—*Journ. Elisha Mitchell Sci. Soc.*, xliv, 2, pp. 242–260, 16 pl., 1929.

The results of two years' studies of several common species of *Septobasidium* found in the vicinity of Chapel Hill, North Carolina, and of material collected in the Blue Mountains, Jamaica, in 1926, have convinced the writer that a symbiotic relation exists between these organisms and the scale insects to which they are attached [*R.A.M.*, vii, p. 63]. The common American species, *S. retiforme*, furnishes a home for the insects in which, protected against their natural enemies and shielded from inclement weather, they may suck the juices of the host plant, grow to maturity, and eventually reproduce in immense numbers. Some of the progeny repeat this cycle, while others are parasitized by the fungus. In the latter case the fungus penetrates the circulatory system of the living insect and there develops numerous elaborate coils which absorb nutriment from the blood of the host. A number of insects are eventually destroyed by the parasite, while others survive to reproduce, and some remain altogether free from infection. The fungus also receives a small amount of nourishment from the excretions given off by healthy insects. In all the other cases investigated, except that of *S. polypodii*, which is parasitic on the sporangia of *Polypodium* sp. in the Blue Mountains of Jamaica, an essentially similar relation exists between the fungus and the scale insects as recorded for *S. retiforme*.

In some cases the fungus also penetrates the bark of the host plant and reaches the living cells. Even in these, however, the symbiotic relationship to scale insects persists.

Descriptions, accompanied by English diagnoses, are given of eight Jamaican species of *Septobasidium*, of which six are new, and of one species of *Helicobasidium*, *H. arboreum* n. sp., occurring on the bark of a living deciduous tree on the Blue Mountain Trail in Jamaica. This species was also associated with scale insects, many of which were parasitized by irregular, bent, spindle-shaped hyphal segments connected by fine threads.

LANGERON (M.). **Mycose d'une larve de Culex hortensis de Corse.** [Mycosis of a larva of *Culex hortensis* in Corsica.]—*Ann. de Parasitol. Humaine et Comp.*, vii, 2, pp. 107–111, 3 figs., 1929.

A mycotic tumour in a larva of a mosquito (*Culex hortensis*)

found in Corsica contained fuliginous, torulose hyphae surrounding the digestive tube (through which entry is thought to have been effected) and penetrating the tracheae. The general appearance of the fungus, which is said to be unlike any of those previously reported on mosquito larvae, resembled that of an *Hormiscium* or a *Torula*.

SEDDON (H. R.). **A skin disease of sheep (mycotic dermatitis).** —*Agric. Gaz. New South Wales*, xl, 4, pp. 309–310, 1 fig., 1929.

Attention of sheep-breeders is called to the occurrence in Australia of a dermatitis in sheep, which has not been hitherto noticed probably owing to its comparative rarity. The main symptom is the formation, chiefly on the back, but occasionally also on the sides, of numerous small scabs, strongly reminiscent of a favus, which bind the wool together and finally fall off, leaving a raw area very liable to become fly-blown. The trouble is believed to be caused by an undetermined fungus which was observed in quantity in the scabby crusts and also penetrating the wool follicles. It was reproduced by rubbing a paste prepared from the crusts on the skin of healthy sheep, especially after scarification, thus demonstrating its contagious nature. Under present conditions in Australia, the only means of control economically possible would be the immediate destruction of affected animals, the carcasses of which should be burnt.

THIENES (C. H.). **A new Monilia-like fungus. Characteristics of an organism associated with a dermatosis peculiar to workers in canneries.**—*Arch. of Dermatology*, xix, 5, pp. 800–806, 4 figs., 1929.

In a previous report (*Arch. of Dermatology*, xi, p. 186, 1925) evidence was presented of the mycotic origin of an occupational dermatosis occurring among workers in certain fruit canneries of the Pacific Northwest and known locally as 'fruit poisoning'. The three original cultures of the *Monilia*-like yeast believed to be the causal organism were obtained in 1924 from two patients with paronychia and one with interdigital erosion; six of the eight new isolations were obtained from similar cases, a seventh from a box of pears just delivered to the cannery, and the eighth from a tray of peelings at the workers' table.

The cells from a 24-hour culture on solid media were round or oval budding forms, 5 to 8 μ in diameter (occasionally up to 10 μ). Forty-eight to 72 hours later many of the cells had assumed extremely irregular shapes and measured up to 15 μ in diameter. Small, greenish bodies found floating free in hanging drop preparations from old colonies were thought to be ascospores, but they did not germinate. Tortuous hyphal forms of one to six segments were abundant in the gnarled masses of giant colonies. The hyphae formed in liquid media were composed of segments 10 to 60 μ long and 2 to 3 μ in breadth, except for the terminal segments, which were up to 100 μ in length and tapering. Conidia were usually borne at the elongated ends of the segments but were occasionally pleurogenous; they frequently bore buds, which in turn gave rise

to fresh ones. In superficial skin lesions the organism developed both hyphae and budding forms, the former predominating, while in the deeper tissues of experimental animals the round cells were most in evidence.

The fungus made profuse growth in 24 hours at 37° C., or three days at room temperature. On solid media the growth was slightly moist, dull white, later showing a faint green tinge, and raised, with a thick creamy consistency. Development was most abundant on alkaline dextrose agar (P_H 7·2). The organism fermented dextrose, levulose, and maltose with the production of alcohol, acetic acid, and carbon dioxide, and galactose with the production of alcohol and acetic acid only. Dilute suspensions of a 24-hour broth culture were killed in 10 minutes at 54°. In its morphological and cultural characters [further details of which are given], the fungus is closely related to *Monilia* or *Parasaccharomyces* [*R.A.M.*, vii, p. 512], but in the present state of confusion regarding the taxonomy of the Blastomycetes [ibid., viii, p. 103] it cannot be definitely identified.

SCHLOSSMANN (C. R.). **Two cases of blastomycosis cutis.**—*Acta Dermato-Venereologica*, x, 2, pp. 83–94, 5 figs., 1929.

Full clinical details are given of two cases of blastomycosis cutis investigated at the Bacteriological Laboratory of Dorpat University (Esthonia). The first patient, a woman aged 40, died as a result of generalized infection, while the second, a man of 46, recovered after a course of local treatment with potassium iodide.

The pathogenic yeast-like organism isolated from case 1 (P.Y. No. 1) was characterized by a marked variability in the shape and size of the cells, which ranged from round or slightly elongated to allantoid and very long forms. Septate hyphae with lateral and terminal buds were formed and a large rounded body, with doubly refractive membrane and granular cytoplasm, was frequently observed at their tips. The cells of P.Y. No. 2 were oval, elliptical, sometimes elongated, and characterized by intensive budding; in older cultures elongated, allantoid cells and long, septate hyphae developed. Both fungi made abundant growth on ordinary solid media, especially where sugar was present, at 25° or 37° C. The zymogenic properties of both were very weak, No. 1 forming acid and gas in dextrose, mannose, and maltose, and No. 2 in dextrose only; neither liquefied gelatine. The organisms were only slightly pathogenic to some laboratory animals and not at all to others.

It is hardly possible to attempt a definite classification of the organisms on the basis of these data, but they are considered to show affinities with *Monilia* or *Parasaccharomyces* [see preceding abstract].

WACHOWIAK (M.), STRYKER (G. V.), MARR (J.), BOCK (H.), & FLEISHER (M. S.). **The occurrence of Monilia in relation to psoriasis.**—*Arch. of Dermatology*, xix, 5, pp. 713–731, 1929.

The examination of material from 56 patients suffering from psoriasis disclosed the presence of *Monilia* sp. in the faeces of 86 per cent., in the blood of 17 per cent., and in skin scrapings of 36 per cent. The organism was found to occur in the intestinal tract

of 6 to 10 per cent. of the normal persons examined for comparative purposes. Although the writers were not successful in demonstrating the existence of a specific relation between *Monilia* and the lesions of psoriasis, the results of their studies and experiments [which are fully described] lead them to the conclusion that the fungus is in some way involved in the etiology of the disease. Support is lent to this hypothesis by the fact that about one quarter of the patients treated by injection with a *Monilia* vaccine were almost completely cured.

TATE (P.). **On the enzymes of certain dermatophytes, or ringworm fungi.**—*Parasitology*, xxi, 1–2, pp. 31–54, 1929.

A full account, accompanied by tables, is given of the writer's researches on the enzymatic activity of the following dermatophytes: *Sabouraudites radiolatus* [*Trichophyton radiolatum*], *S. lanosus* [*Microsporon lanosum*], *S.* [*M.*] *audouini*, *T. tonsurans*, and *Grubyella* [*Achorion*] *schoenleini*. An active proteolytic enzyme, very similar to trypsin in its behaviour, was found in all the species, being specially abundant in *T. radiolatum*; it is active in an alkaline medium and can hydrolyse intact proteins (casein) with the production of free amino-acids (tryptophane). Lipase was detected in all the species, and urease in all except *T. tonsurans*. Maltase, diastase, and amygdalase were present in all. The species with most proteolytic activity had the least carbohydrases, and conversely. The normal form of *T. radiolatum* showed greater proteolytic activity than the pleomorphic one.

LEGGE (R. T.), BONAR (L.), & TEMPLETON (H. J.). **Ringworm of the feet. Preliminary report.**—*Journ. Amer. Med. Assoc.*, xcii, 18, pp. 1507–1508, 1929.

Mycological studies are in progress (and will shortly be reported) on the fungi (chiefly *Trichophyton interdigitale*) isolated from cases of ringworm of the feet which occurred in $52\frac{1}{3}$ per cent. of the men and $15\frac{1}{3}$ per cent. of the women who had entered the University of California in the autumn of 1928 [cf. *R.A.M.*, vii, pp. 635, 636; viii, p. 37]. Many of the students come from India, China, and Japan, and it is thought probable that the ringworm fungi have been introduced from these countries.

LANGERON (M.). **Le Trichosporium pedrosoi (Brumpt, 1921) agent de la dermatite verruqueuse brésilienne.** [*Trichosporium pedrosoi* (Brumpt, 1921) the cause of verrucose dermatitis in Brazil.]—*Ann. de Parasitol. Humaine et Comp.*, vii, 2, pp. 145–150, 2 figs., 1929.

From a study of the fungus isolated by Pedroso in 1913 from a case of human verrucose dermatitis in Brazil, and named by him *Phialophora verrucosa*, the author has concluded, in agreement with Brumpt and Ota, that this organism is a *Trichosporium*.

When the fungus is cultured on the usual media elongated conidia form at the upper part of a short terminal or lateral conidiophore. The unicellular, elongated conidia are generally isolated, sessile (directly inserted on the wall of the conidiophore and without trace of a stalk or papilla); they are closely grouped

and cover the end of the conidiophore completely. Sometimes, especially in cell cultures or liquid media, the tip of the conidiophore has several terminal branches which bear conidia or chains of ovoid articulations, the distal one of which is surmounted by true conidia. These formations resemble those seen in the genus *Hormodendrum* except that disjunctors are absent. In certain cultures on Sabouraud's glucose agar, yeast-like elements may appear, forming a transitional stage to other isolated or grouped bodies which consist of thick, yeast-like, often septate, distinctly brown elements, the presence of which has given the disease its name blastomycosis or chromoblastomycosis.

It is concluded that the fungus should be known as *Trichosporium pedrosoi* Brumpt (synonyms: *Hormodendrum pedrosoi*; *Acrotheca pedrosoi* (Brumpt) Terra, Torres, da Fonseca, and Leão; *Trichosporium pedrosianum* Ota).

VALLERY-RADOT (PASTEUR) & GIROUD (P.). **Sporomycose des pelleteurs de grains.** [Sporomycosis among grain shovellers.]—*La Presse Méd.*, xxxvi, 95, p. 1520, 1928.

During the summer of 1928 some men employed in shovelling barley grain at a brewery in the east of France developed tracheobronchial symptoms, which were found to be due to the presence in the air of spores of *Aspergillus fumigatus* and *Mucor mucedo* which were growing on the grain. The specificity of the former organism was demonstrated by positive intracutaneous and precipitation reactions with an extract of the *Aspergillus*; *M. mucedo* was apparently devoid of antigenic properties and evoked no humoral reactions. Inquiries elicited the information that such symptoms are not unknown in other small breweries, where the work is frequently discontinued on that account during hot weather. This condition is not accompanied, like aspergillosis proper [cf. *R.A.M.*, iii, p. 222; vi, p. 416], by the reproduction of the fungus in the respiratory organs, which in the present case are merely irritated by the inhalation of the spores.

TALICE (R. V.) & MACKINNON (J. E.). **Penicillium bertai n. sp. agent d'une mycose broncho-pulmonaire de l'homme.** [*Penicillium bertai* n. sp. causing a broncho-pulmonary mycosis of man.]—*Ann. de Parasitol. Humaine et Comp.*, vii, 2, pp. 97–106, 1 fig., 1929.

From the sputum of an Italian, aged 58, resident in Uruguay and suffering from a chronic condition simulating pulmonary tuberculosis, the authors repeatedly isolated what they consider to be a hitherto undescribed species of *Penicillium*. The fungus [the cultural characters of which on various media are described] was characterized by erect conidiophores, 20 to 90 μ long and slightly swollen at the tip, on which up to 5 elliptical phialids averaging 9·2 by 2·25 μ were borne. From these developed small, divergent chains of up to 20 smooth, round or oval conidia, the diameters of which increased progressively from the phialid to the opposite end of the chain, and ranged from 1·75 to 3·5 μ. On solid and liquid media the fungus diffused an orange-yellow pigment.

In view of these characters the authors consider that the fungus

belongs to the sub-genus *Aspergilloides*, and name it *P. bertai*. This is stated to be the first record of a *Penicillium* of the *Aspergilloides* type as parasitic in the human respiratory tract.

Inoculations of a guinea-pig and a rabbit gave negative results.

MONTEMARTINI (G.). **Contributo allo studio delle micosi spleniche.** [Contribution to the study of the splenic mycoses.]—*Boll. Ist. Sieroter. Milanese, 1928*, 7, p. 637, 1928. [Abs. in *Zentralbl. für Bakt.*, Ab. 1 (Orig.), xciv, 1–2, p. 22, 1929.]

The direct inoculation of three different strains of *Aspergillus* into the spleens of 17 dogs failed to result in the development of symptoms analogous to those of Gamna's disease with which they have been stated by various workers to be associated [*R.A.M.*, vii, p. 782]. In view of the paucity of isolations obtained by other workers, and of the absence of any clear proof of the pathogenicity of the fungi, the author considers it premature to implicate the latter in the etiology of splenomegaly [see next abstract].

ABRIKOSSOFF (A.). **Über 'Splenomykosen' und 'mykotische Splenomegalien'.** [On 'splenomycoses' and 'mycotic splenomegalies'.]—*Virchows Arch.*, cclxxii, 3, pp. 593–612, 16 figs., 1929.

As a result of his investigations [which are fully described] and of a survey of the relevant literature, the writer concludes that the siderofibrotic structures occurring in the spleens of persons suffering from splenomegaly are in no way related to fungous infection [see preceding abstract]. The occasional isolation of *Aspergillus* spp. from diseased organs merely indicates that these fungi sometimes occur in the spleen, and affords no conclusive proof of their implication in the causation of splenomegaly. In the writer's opinion, there is little ground to suppose that fungi are in any way concerned in the etiology of this disease.

MANALANG (C.). **Report of a case of rhinosporidiosis.**—*Philipp. Journ. of Sci.*, xxxviii, 4, pp. 437–441, 3 pl., 1929.

Notes are given on the results of a histological examination of the nasal polypi removed from a seven-year-old Filipino boy. The white, friable, papillomatous tissue contained numerous cysts of varying shape measuring 10 to 100 μ in diameter and usually filled with granular, often vacuolate material and occasional nuclear bodies. Fragments of tissues boiled for a few minutes in 10 to 15 per cent. potassium hydrate solution were found to contain numerous scattered refractile bodies (sporoblasts), about 8 μ in diameter, occupied by six or more refractile spores. Large mature cysts were filled with sporoblasts, which were liberated in large numbers when the cyst wall was broken. It is not yet certain whether the causal organism of this particular type of rhinosporidiosis is *Rhinosporidium seeberi* [*R.A.M.*, vii, p. 719] or *R. kinealyi*. This is believed to be the first report of the disease in the Philippines.

LAXA (O.). **Eine Fusariumart als Ursache eines Käsefehlers.** [A *Fusarium* species as the cause of a defect in cheese.]—*Zentralbl. für Bakt.*, Ab. 2, lxxviii, 1–7, pp. 93–95, 1 fig., 1929.

Small cheeses from a Moravian dairy were found to be covered by an oily, brownish coating, shading off in places into a pink tinge. A species of *Fusarium*, believed to be identical with *F. sarcochroum* [*R.A.M.*, vi, p. 531], was isolated from the affected material and cultured on whey gelatine, cheese decoction gelatine, whey agar, and other media [which are enumerated, with notes on the characters of the fungus on each]. The characteristic lunate conidia measured 5·4 to 25·2 μ in length, and are shown in the figure as having 1 to 7 septa: microconidia are also depicted. The defect produced in the cheese by the action of this fungus was found to be transmissible to sound cheeses. However, provided the coloration is not too intense, the *Fusarium* exerts a beneficial action on the aroma and flavour of the cheese. The introduction of *Penicillium candidum* into the mass serves to prevent an excessive development of colour.

DODGE (B. O.). **Fungous diseases and insects in the Rose garden.**—*Journ. New York Bot. Gard.*, xxx, 353, pp. 105–124, 3 figs., 1929.

Black spot (*Diplocarpon rosae*), mildew [*Sphaerotheca pannosa*], and brown canker (*Diaporthe umbrina*) are stated to be the most destructive rose diseases in the New York Botanical Garden, while the common stem canker (*Coniothyrium fuckelii*) [*Leptosphaeria coniothyrium*] is also prevalent, especially on hybrid perpetuals. Observations on varietal reaction to black spot and mildew in 1928 showed that, among the 364 [listed] varieties, there was a considerable difference in susceptibility as judged by the ease with which infection could be controlled by spraying. As ordinary Bordeaux mixture and sulphur were unsuitable on account of foliage staining, the bushes were regularly (*a*) sprayed with a commercial ammoniacal copper carbonate solution (containing also nickel carbonate), or (*b*) dusted with a 300-mesh sulphur dust dyed green. Both treatments were effective in controlling black spot on many varieties, of which 222 withstood infection altogether, 99 were semi-resistant, and 43 susceptible. Generally speaking, the hybrid Rugosas and climbers are moderately resistant to black spot, and would need no protection under ordinary conditions. Some of the climbers that are susceptible to mildew were kept almost completely free from this disease by the spray solution. On the whole the experiments indicate that both black spot and mildew can be kept under control by regular spraying, supplemented in cases of severe or prolonged attacks by sulphur dusting.

LAUBERT (R.) & TRAPPMANN (W.). **Krankheiten und Beschädigungen an Azaleen und Rhododendren.** [Diseases and pests of Azaleas and Rhododendrons.]—*Biol. Reichsanst. für Land- und Forstwirtsch. Flugbl.* 99–100, 8 pp., 6 figs., 1929.

Popular notes are given on the etiology, symptoms, and control of the following fungous diseases of rhododendrons and azaleas:

Exobasidium japonicum (named by several authors *E. azaleae*), chiefly affecting the Prof. Wolters variety of *Azalea indica* [*Rhododendron indicum*] and first reported in Germany as in other European countries between 1906 and 1908; *E. rhododendri* on *R. hirsutum* and *R. ferrugineum*, especially in the Alps [*R.A.M.*, vi, pp. 466, 587]; leaf spot of azaleas (*Septoria azaleae*) [ibid., vii, p. 641]; and Alpine rose rust (*Chrysomyxa rhododendri*) [ibid., vii, p. 686].

DRAYTON (F. L.). **Bulb growing in Holland and its relation to disease control.**—*Scient. Agric.*, ix, 8, pp. 494–509, 8 figs., 1929.

This is a brief account of the author's visit in 1928 to Holland, at the invitation of the Netherlands Government, for the purpose of studying the conditions under which flowering bulbs are grown in that country, and of co-operating in the elaboration of disease control measures in order to obviate the restrictions set up by the Canadian Department of Agriculture on the importation of gladiolus corms from Europe. In describing the Dutch methods of cultivation, high appreciation is expressed of the measure of freedom from disease attained in the case of tulips, hyacinths, and narcissi, which form the main bulk of the Dutch bulb export trade. The gladiolus, on the other hand, is comparatively neglected by the bigger commercial firms, and is chiefly grown by small-holders. This in part explains the considerably higher incidence of various gladiolus diseases, among which the more important are: hard rot (*Septoria gladioli*), dry rot (*Sclerotium gladioli*), scab or neck rot (*Bacterium marginatum*) [*R.A.M.*, vii, pp. 327, 641, 724], and a neck rot and corm disease caused by an undetermined fungus of the *Botrytis* type. The attention of the plant pathologists and growers in Holland was directed to the investigations of these diseases in Canada, and suggestions [a summary of which is given] were made as to the best means for their control.

ZONDAG (J. L. P.). **Phyllosticta gemmipara n. sp. oorzaak eener ziekte van Amaryllis (Hippeastrum hybridum).** [*Phyllosticta gemmipara* n. sp. the cause of a disease of Amaryllis (*Hippeastrum hybridum*.)]—*Tijdschr. over Plantenziekten*, xxxv, 4, pp. 97–107, 3 pl., 1929. [German summary.]

Amaryllis (*Hippeastrum hybridum*) plants in Europe and America are stated to be subject to a fungous disease characterized by elongated red (later brown) spots with pale margins on the leaves and red lines on the stalks. On the leaf spots, pycnidia can be seen with a lens as small dark specks. In very severe cases the pedicels and inflorescences may show signs of arrested development. On the bulbs the lesions remain superficial and cause no decay of the tissues. In pure cultures on cherry agar the fungus forms hyphae with terminal or intercalary chlamydospores and also pycnidia; the latter have a short papilla and measure approximately 128 μ in diameter. The average dimensions of the hyaline, mostly unicellular but occasionally bicellular pycnospores are 9 by 4·5 μ. The fungus is considered to be a *Phyllosticta* which is named *P. gemmipara* n. sp., with a diagnosis in German. Inocula-

tion experiments both with germinating spores and old mycelium gave positive results on unwounded leaves (upper or under side). Small appressoria are formed at the points where the hyphae penetrate the cuticle; subsequently sclerotial bodies are produced in the epidermal cells, from which hyphae grow out to infect the neighbouring tissues.

GRIESSMANN (K.). **Die Bedeutung der botanisch-mikroskopischen Futtermittelkontrolle bei der Aufklärung und Verhütung von Tierkrankheiten.** [The importance of the botanical and microscopical examination of fodders in the elucidation and prevention of animal diseases.]—*Deutsche Landw. Presse*, l, 20, p. 287; 21, p. 305, 1929.

In the course of a discussion on the value of the microscopical examination of fodders in determining the cause and in the prevention of animal diseases, the writer cites various cases of illness among stock due to the presence of fungous infection. Thus, sheep and cows suffered ill effects from the consumption of soy-bean groats permeated by the mycelium of a mould, while repeated attacks of colic in horses were traced to the presence of a fructifying mycelium in the ground beet forming the principal constituent of a molasses fodder. On account of the prevalence of poisoning among swine consuming American barley in the west and north-west of Germany [*R.A.M.*, viii, p. 98], the Government has ordered an analysis to be made of all consignments imported from certain districts of North America during a given period. No definite conclusion appears to have yet been reached as to the cause of the toxicity of this barley, which is reported (*Zentralbl. deutsch. Landwirtschaftsrats*, p. 449, 1928) to have caused similar effects in the United States [ibid., viii, p. 553].

PALMÉR (J.). **Bör man beta Klöverfrö?** [Should Clover seed be steeped?]—*Landtmannen*, xii, 17, p. 374, 1929.

Not only did red clover [*Trifolium pratense*] seed of the 1928 harvest fail to respond to the alleged stimulatory action of certain fungicides (in this case uspulun dust and uspulun-universal at 0·25 or 0·5 per cent.), but a considerable reduction of germination was observed. This is a further confirmation of the already familiar fact that the apparent stimulus to growth given by various disinfectants is due solely to their fungicidal action.

HOWITT (J. E.) & LAWSON (C.). **The more important fruit tree diseases of Ontario.**—*Ontario Dept. of Agric. Bull.* 344, 45 pp., 32 figs., 1929.

Popular notes are given on the symptoms, etiology, and control of some well-known fruit diseases occurring in Ontario, together with some suggestions for spraying and the use of spray equipments.

GUYOT (L.). **Les maladies des fruits.** [Fruit diseases.]—*La Nature*, 2794, pp. 296–300, 1928; 2802, pp. 118–124, 20 figs., 1929.

This is a popular account of the principal fruit diseases occurring

in the Rhone Valley, the annual loss from which is estimated at Fr. 20,000,000 or one-third of the total value of the harvest [*R.A.M.*, viii, pp. 180, 181]. Directions are given for the control of these diseases.

GUYOT (L.). **La conservation des fruits.** [Fruit preservation.] —*La Nature*, 2811, pp. 543–551, 9 figs., 1 chart, 1929.

Popular notes are given on the cultivation and production of fruit in France, with special reference to the prevention of disease in transport and storage [see preceding abstract].

TULLIS (E. C.). **Studies on the overwintering and modes of infection of the fireblight organism.**—*Michigan Agric. Exper. Stat. Tech. Bull.* 97, 32 pp., 2 pl., 2 diags., 1929.

Fireblight (*Bacillus amylovorus*) is stated to be one of the most important diseases of apples, pears, and quinces in Michigan.

The causal organism usually overwinters in the marginal region of the cankers [*R.A.M.*, viii, p. 315], but in two cases it has been found to remain viable from the autumn till the following spring in dead tissue as far as twelve inches within the canker edge.

B. amylovorus may be disseminated by a number of insects [a list of which is given], bees being an important factor in establishing sources of infection in the blossoming tree. Rain plays a considerable part in the further spread of the disease after the establishment of the primary sources of infection. A fairly close correlation may exist between periods of twig infection and spells of wet weather.

The infection of healthy leaves is of common occurrence, the stomata affording means of ingress for the fireblight organism. Greenhouse and field experiments under optimum conditions gave 75 and 25 per cent. leaf infection, respectively. Fresh wounds of leaves, fruit, limbs, and trunks doubtless afford a common seat of infection during rainy periods. Stomatal infection usually results in twig blight if it occurs in very young leaves of growing twigs, while leaf spot is the outcome of infection of nearly mature foliage.

The movement of the pathogen in the tissues appears to be one of mass action, the organisms being confined to the gelatinous matrix in which they are embedded [ibid., viii, p. 249]. In none of the preparations examined were bacteria observed to be in advance of this matrix.

The measures recommended for the control of fireblight include the excision of infected parts; the adoption of cultural practices tending to the moderate development of twig growth; and the use of resistant varieties as stocks.

JONES (D. H.). **Fireblight and its eradication.**—*Ontario Dept. of Agric. Bull.* 342, 22 pp., 27 figs. (1 on cover), 1929.

This is a popular account, illustrated by excellent photographs, of the symptoms, etiology, and control of fireblight (*Bacillus amylovorus*), which in Ontario mainly affects apple, pear, and quince trees [see preceding abstract].

FOLSOM (D.) & AYERS (T. T.). **Apple spraying experiments in 1926 and 1927.**—*Maine Agric. Exper. Stat. Bull.* 348, pp. 145–176, 2 graphs, 1928. [Received August, 1929.]

In continuation of previous investigations on the efficacy of various methods of control of apple scab [*Venturia inaequalis*] in Maine [*R.A.M.*, vi, p. 167], the writers give a full account, supplemented by tables, of their spraying experiments during 1926–7.

Tests were made of various spray schedules, differing as to the number (up to five) and dates of the applications but using the same material as a fungicide (dry lime-sulphur 4–50, plus 1 lb. dry lead arsenate for the calyx and 12-day applications). It was found that the pre-pink application might reduce the percentage of scab without being essential to good control, while in one season the pre-pink, pink, 4-week, and August applications each contributed to the reduction of infection. Scab appearing first in storage was found to be sometimes due to the occurrence of infection before an August application; the latter may considerably mitigate the severity of the attack. Storage scab was not consistently affected by slight fluctuations in storage temperatures near 32° F. Lesions apparent at packing time did not enlarge in storage, and infection was not transmitted by handling in picking and packing operations.

Leaf burning, both in the Ben Davis and McIntosh varieties (especially the former), was induced by spraying, particularly in the later applications. However, the decline in the incidence of scab through the extra applications counterbalanced this injury. The financial profit of a schedule or of any single application differs with the season and also according to the variety. McIntosh requires more applications and the appearance of the fruit is not adversely affected by the additional sprays. No consistent correlation was observed between spraying and fruit dropping.

The results of 11 applications of sulphur dusts (kolodust [ibid., vii, p. 565] and kolotex), which were included in the tests for comparative purposes, proved somewhat disappointing, especially as regards leaf scab, while the disease also subsequently appeared in storage. Russeting, though less than in the sprayed plots, was present to an appreciable extent.

A survey of untreated trees showed that the amount of fruit scab is largely determined by the incidence of infection on the leaves. Little difference in the extent of infection was observed between trees receiving varying quantities of nitrate of soda as a fertilizer.

In the McIntosh variety twig infection was often found to cause heavy infection of the leaves and fruits, notwithstanding the spraying of the twigs and foliage. The twig pustules usually cause foliage infection later in the season than do the ascospores of the fungus [ibid., viii, p. 250]. The ascospores develop differently according to season and locality, are more abundant on leaves bearing summer lesions, and were not controlled in these experiments by an autumn application of 5–50 copper sulphate solution.

Storage scab and the twig infection and russeting of McIntosh are considered to be problems requiring further investigation.

MAYNARD (J. G.) & MARSH (R. W.). **Spraying trials against Apple scab at Long Ashton in 1928.**—*Ann. Rept. Agric. and Hort. Res. Stat., Long Ashton, Bristol, for 1928*, pp. 112–123, 1 chart, [1929].

Detailed observations were made at Long Ashton during 1928 on scab [*Venturia inaequalis*] control, spray damage, and costs of spraying on plots of standard apple varieties, i. e., Bramley's Seedling, Worcester Pearmain, Lane's Prince Albert, Allington Pippin, Edward VII, Cox's Orange, Grieve, and Stirling Castle.

The treated plots received two pre-blossom applications of excess-lime Bordeaux mixture (4–8½–50), followed by a post-blossom spray of either (1) weak Bordeaux mixture (2–5–50) or (2) double-strength colloidal sulphur (10–100). The yield of clean fruit on all the treated plots ranged from 94 to 100 per cent., compared with only 60 per cent. on one row of Lane's Prince Albert left unsprayed as a control.

Temporary damage was inflicted on Bramley's Seedling, Prince Albert, Allingtons, and Grieves by the excess-lime Bordeaux mixture, but no permanent detrimental effects were produced on the trees. On the other hand, serious injury was caused to the Stirling Castle and Prince Albert varieties by the colloidal sulphur treatment. One-half to two-thirds of the trees of the former variety were defoliated, while 70 per cent. of the fruit dropped in one block of the latter during the first fortnight after spraying. In the present series of experiments, the time of application of the sprays happened to coincide with periods of severely arrested growth, principally owing to unfavourable winds, and this factor may possibly have contributed to the spray damage.

The costs of the spraying experiments are expressed in tabular form. Reckoning the men's wages at tenpence per hour, the total cost of the pre-blossom treatment on three plots covering 6·25 acres was £29 1*s*. 4*d*. and that of the post-blossom sprays £18 16*s*. 9*d*. Generally speaking, the cost of material was only about one-third of the total, the balance of the expenditure being accounted for by labour charges. An economy in this direction through the use of power sprayers is, therefore, highly desirable.

LUDWIGS (K.). **Ist die Fusicladiumbekämpfung mittels Schwefelkalk- oder Kupferkalkbrühe wirtschaftlich?** [Does *Fusicladium* control with lime-sulphur or Bordeaux mixture pay?]—*Obst- und Gemüsebau*, lxxv, 5, pp. 88–90, 1929.

The writer analyses the statistical data compiled as the result of a preliminary inquiry conducted in 1928 by the plant protection head-quarters of the Chamber of Agriculture for the province Brandenburg and Berlin into the respective merits of Bordeaux mixture and lime-sulphur for the control of *Fusicladium* [*Venturia inaequalis*] on apples and *F.* [*V.*] *cerasi* on Morello cherries. The estimated gain from spraying 15 standard Baumann's Pippin apples with Bordeaux mixture (two applications) was M. 25·89, the corresponding figure for lime-sulphur being M. 25·39. On Golden Pearmain (same treatments) there was a loss of M. 2·10 through the use of Bordeaux mixture compared with a gain of M. 8·06 for

lime-sulphur. The estimated gain from three applications of Bordeaux mixture on 20 heavily infected espalier cherries was M. 13·26, compared with M. 14·90 for lime-sulphur.

PAILLOT (A.) & PUSSARD (R.). **Le traitement des arbres fruitiers contre le Carpocapse et la tavelure.** [The treatment of fruit trees against *Carpocapsa* and scab.]—*Journ. d'Agric. Prat.*, xciii, 18, pp. 350–352, 1929.

Very good results were obtained in the combined control of *Carpocapsa* [*Cydia pomonella*] and scab [*Venturia pirina*] in an orchard containing 295 Williams Bon Chrétien pear trees at Ampuis (Rhone Valley) in the spring of 1928 [*R.A.M.*, i, p. 110]. The trees were sprayed first on 16th April after petal fall, and again a fortnight later, with a mixture consisting of 1 kg. copper sulphate, 3 kg. powdered hydrated lime (1·5 to 2 kg. is sufficient), 0·750 kg. lime arsenate (paste), 0·100 kg. casein, and 100 l. water. The estimated total cost of the spraying operations, including labour and depreciation, was Fr. 630. The incidence of scab was reduced from 50 per cent. or more to less than 3 per cent., and the additional value of the treated over the unsprayed fruit was placed at Fr. 5,000.

CHILDS (L.). **The relation of woolly Apple aphis to perennial canker infection with other notes on the disease.**—*Oregon Agric. Exper. Stat. Bull.* 243, 31 pp., 11 figs., 1929.

The results of investigations, extending from 1925 to 1928, on perennial canker of apples (*Gloeosporium perennans*) [*R.A.M.*, vi, p. 361; viii, pp. 49, 50] in the Hood River Valley of Oregon have shown that the causal organism is a wound parasite apparently incapable of penetrating sound, uninjured tissue. The canker is not truly perennial, new annual infections occurring where conditions are favourable to the spread of the disease.

The woolly aphis (*Eriosoma lanigerum*) was shown by experiments [which are fully described and the results tabulated] to be definitely associated with canker infection [ibid., viii, p. 357]. Pruning wounds and canker calluses on which the insect did not feed failed to develop a single infection, whereas about 90 per cent. infection occurred in the wake of aphid infestation. Canker infection has usually been found to follow severe late aphid infestations, though sometimes early attacks may have the same effect.

The extent of canker advance is largely determined by winter temperatures. The infection following aphid attacks during winters with minima of 6° and 20° F. has been superficial, whereas a noticeable increase was observed at a range of −2° to −27°, the severity of the disease being in direct proportion to the fall in temperature. This phenomenon may be explained by the fact that the aphid galls undergo only slight cracking during the summer and in mild winters, while at temperatures below 0° they usually rupture and collapse on thawing; in the latter condition the callus apparently permits the entrance, followed by extensive spread, of the canker organism.

Pruning wounds made in the winter have sometimes been followed by infection, which has scarcely been observed in cuts made

after the middle of February, when callus growth seems to be more vigorous than during the colder months. All pruning wounds are potential canker centres, since practically every one is ultimately infested by woolly aphis. Cutting to stubs on the main framework of the tree is recommended as a means of preventing the rapid advance of canker infections. Painting the wounds with Hood River tree paint (containing rosin, fish oil, and copper sulphate) has also given a certain degree of control, reducing the incidence of infection from 65·5 to 12·5 per cent. in one test, but the application of Bordeaux mixture, nicotine sulphate, and other preparations proved unsatisfactory.

The leading commercial apple varieties in the Hood River Valley, viz., Newtown, Ortley, and Spitzenburg, are highly susceptible to *G. perennans*. The planting of red sports of Delicious is recommended, since this variety shows much more resistance to canker than others adaptable to the region in question. The Northern Spy variety is usually free from infection, while in Lady Apple, Transcendent Crab, Arkansas Black, and Black Twig, the cankers seldom advance far into the bark.

G. perennans induces the development of the so-called 'bull's eye rot' in stored fruit. Early picking and the use of Bordeaux mixture (4–4–50) in the last codling moth [*Cydia pomonella*] spray have been found effective in reducing the attack on the fruit.

GUYOT (A. L.). **Les maladies des arbres fruitiers à noyau.** [The diseases of stone-fruit trees.]—46 pp., 3 figs., Paris, Librairie Agricole de la Maison Rustique, and Villefranche (Rhône), Librairie du Progrès Agricole et Viticole, [(?) 1929.]

In this booklet, no. 187 of the Bibliothèque Vermorel ('Les petits manuels des syndicats agricoles'), the author gives a succinct account in popular language of the symptoms, mode of infection, and control of common fungous diseases of stone-fruit trees [all of which have already been dealt with in this *Review*]. These comprise *Monilia* disease [*Sclerotinia cinerea*] of apricots, peaches, plums, and cherries; *Coryneum* [*Clasterosporium carpophilum*] of the same hosts and also of almonds; rust (*Puccinia pruni-spinosae*) of apricots, peaches, and plums; mildew (*Podosphaera oxyacanthae*) of apricots and plums; leaf curl (*Exoascus* [*Taphrina*] *deformans*) of peaches and almonds; mildew (*Sphaerotheca pannosa*) of peaches; plum pocket disease of plums (*E.* [*T.*] *pruni*); and witches' broom (*E.* [*T.*] *cerasi*) and leaf scorch (*Gnomonia erythrostoma*) of cherries. Notes are also given on chlorosis, root rots (*Armillaria mellea* and *Rosellinia necatrix*), gummosis, sooty mould [*Capnodium* and *Fumago* spp.] and silver leaf disease (*Stereum purpureum*) of the same hosts.

BROOKS (F. T.) & BRENCHLEY (G. H.). **Injection experiments on Plum trees in relation to Stereum purpureum and silver leaf disease.**—*New Phytologist*, xxviii, 3, pp. 218–224, 1929.

During the last three years a number of injection experiments have been carried out on Victoria and Czar plum trees in connexion with the silver leaf disease caused by *Stereum purpureum*. The

technique used in previous trials by Brooks and Moore was again found very satisfactory for this purpose [*R.A.M.*, v, p. 502].

It was found that silvering of the foliage and other pathological symptoms, e.g., browning of the flowers and leaf tips, could be induced in plum trees by the injection into their stems of a filtered, non-living extract of the mycelium of *S. purpureum*, crushed with sterilized sand in the culture fluid in which the fungus was grown. The same effects may be produced by the injection only of the culture fluid in which the fungus had grown for two years, but when fluid from young cultures was used, silvering did not always follow. Boiling the fluids for five minutes before injection was found to inhibit silvering, but did not prevent the development of other pathological symptoms. The culture fluids, boiled or unboiled, induce an extensive brown, gummy discoloration of the wood, similar to that caused by the growth of *S. purpureum*, near the injection holes.

CHABROLIN (C.). **Les dépérissements de l'Abricotier.** [The die-back of the Apricot.]—*Comptes rendus Acad. d'Agric. de France*, xv, 14, pp. 583–588, 1929.

The problem of the etiology of the die-back of apricots affecting the orchards of the Rhone Valley and elsewhere in France, and now reported from Algeria, Tunis, the United States, Tuscany, and Switzerland, is still awaiting solution. The writer does not agree with Joëssel that the modifications in the woody tissues are a primary symptom of the disease and are due to *Verticillium dahliae* [*R.A.M.*, viii, p. 180], nor can he accept Rives's work [ibid., viii, p. 388] as giving a satisfactory explanation of its causation. Further investigations (including a systematic study of the relations between stock and scion) are necessary to determine the nature of the causes responsible for die-back.

MARSH (R. W.) & MAYNARD (J. G.). **A preliminary note on the control of Black Currant leaf spot (Pseudopeziza ribis).**—*Ann. Rept. Agric. and Hort. Res. Stat., Long Ashton, Bristol, for 1928*, pp. 109–111, 2 pl., [1929].

Excellent control of *Pseudopeziza ribis*, the cause of black currant leaf spot [*R.A.M.*, vii, p. 616; viii, p. 390], was obtained on a plot of 4·3 acres of the Baldwin variety by spraying on 20th July (immediately after picking) with 4–4–50 or 2–4–50 Bordeaux mixture, applied by means of Herrod's Demon Hand Sprayer with two nozzles. It was found that the buds from the treated bushes were 15·3 per cent. heavier than those from the unsprayed, and that the former retained their leaves until the normal time of shedding, whereas the latter became entirely defoliated during September.

SIDERIS (C. P.). **Rhizidiocystis ananasi Sideris, nov. gen et sp., a root hair parasite of Pineapples.**—*Phytopath.*, xix, 4, pp. 367–382, 9 figs., 1929.

Working at the Hawaiian Pineapple Canners' Association Experiment Station, Honolulu, the writer has found in diseased pineapple roots an apparently undescribed Chytridiacean fungus to

which he gives the name *Rhizidiocystis ananasi* n. g., n. sp., with a diagnosis in English. This name supersedes the former designation of the organism as *Nephromyces rhizidiophthoreus* Sid. (*Pineapple News*, xi, p. 102, 1927), the name *Nephromyces* having previously been used by Giard (*Comptes rendus Acad. Sci.*, cvi, p. 1180, 1888) for a fungus found in the kidney of certain ascidians. *Rhizidiocystis* is considered to belong to the Cladochytriaceae.

R. ananasi forms a white, evanescent mycelium composed of slender, filamentous, arachnoid hyphae, 1 μ or slightly more in diameter, and spherical, triangular, or irregular turbinate cells ('Sammelzellen'), 1 to 6 μ in diameter and bearing one to eight hyphal branches. Each of these branches terminates in a kidney-shaped body which the author regards as a zoosporangium (though they have not been observed to form zoospores) about 16 by 8 μ in diameter. From the concave side of this body an emission tube grows out, which penetrates the root hair wall and serves to discharge the contents of the kidney-shaped body in a plasmodial state into the interior of the hair, where it grows as a plasmodium, killing and assimilating the protoplasm of the host cell. Resting spores (for which the author uses the term hypnospores), are borne on small tubular outgrowths from the convex side of the 'sporangia', which swell at the tip to a spherical or slightly ellipsoidal body, about 20 μ in diameter, and become rough or echinate. They appear to germinate only during the spring months (chiefly April and May) at temperatures between 28° and 34° C., and produce mycelium but never zoospores.

R. ananasi is a strict parasite, confined to the root hairs of the pineapple, all of which may be destroyed under conditions favouring the growth of the fungus, while the main root tissues become atrophied and the roots gradually wilt and die. No development of the organism occurred in any other living tissue of pineapples or other plants tested, or on natural or synthetic culture media. Approximately pure growths were, however, obtained by transferring very small pieces of infected roots to healthy roots of plants grown in sterilized sand and making successive transfers of the newly infected tissues at short intervals. *R. ananasi* appears to be more or less restricted to pineapple fields of comparatively recent cultivation (up to 20 years), and so far it has not been reported outside of Hawaii. Some prophylactic sanitary measures are briefly outlined.

HIURA (M.). **On a new leaf spot disease of the Japanese Persimmon caused by Mycosphaerella nawae.**—*Res. Bull. Gifu Imper. Coll. of Agric.*, 5, 38 pp., 4 figs., 1929. [Japanese, with English summary.]

About twenty years ago Japanese persimmons (*Diospyros kaki* var. *domestica*) in the province of Mino, Honshu, began to be seriously damaged by a disease now commonly known as 'fruit dropping', from the symptom accompanying severe leaf infection. The spots occurring on the affected foliage closely resemble those caused by *Cercospora kaki* [*R.A.M.*, viii, p. 453], except that they are round instead of angular, more lustrous, and of a paler brown than those of the latter fungus. The perithecia of the fungus

responsible for the fruit-dropping disease usually begin to appear on the lower surface of old lesions early in November, but they never mature before the following May on the fallen leaves, the ascospores being ejected from the middle of June to the beginning of July. The perithecia are obscurely papillate, black, globose, and measure 50 to 100 μ (average 60 to 75 μ); the obclavate asci are 24 to 45 by 4 to 7 μ (average 30 to 36 by 5 to 6 μ); and the hyaline, clavate, uniseptate ascospores are 6 to 12 by 2·4 to 3·6 μ (average length 8 to 10 μ). The fungus is named *Mycosphaerella nawae* Hiura et Ikata, with an English diagnosis. Good control was given by the application of Bordeaux mixture in the middle of June.

CORNELL (F. D.) & CRANE (H. L.). **Stationary spraying systems in West Virginia orchards.**—*Agric. Engin.*, x, 5, pp. 160–164, 6 figs., 1 diag., 1929.

During the past eight years six West Virginia fruit growers have installed nine separate hydrant or stationary spraying systems [*R.A.M.*, viii, p. 586]. In this paper the writers present a number of facts, figures, and recommendations obtained from the owners of these apparatuses.

All were agreed as to the necessity of plentiful water supplies, situated if possible so that the flow can be obtained at the mixing tanks by gravity. The tanks should be able to be rapidly filled.

The type of engine used is less important than its capacity for the development of adequate power. Successful results have been obtained with a 16 h.p. steam-engine, the steam being utilized in making the lime-sulphur spray; a Hercules 35 h.p. gasoline engine; a Ford motor engine; a Stearns-Knight motor engine; a 10–20 International tractor; and an Edwards one-cylinder engine capable of developing 6 h.p. Some of these engines had cost only $10, showing that adequate power can be very cheaply procured. Power is generally transmitted by gearing the pump direct to the drive shaft of the engine.

Some highly satisfactory pumps for use with the stationary spray system are now on the market, e.g., the three-cylinder domestic Giant, capable of delivering 80 galls. per minute under 500 lb. pressure; the Bean three-cylinder (16 galls. under 400 lb.); and Myers Bulldozer (10 to 12 galls. under 300 lb.). The spray guns in use on the stationary spraying systems are the Boyce, Friend Pilot, Friend Hi-lo, Bean Pilot, and Hardy. In all the systems except one the spray crew consists of three men, two for the hose and one for the gun. In one orchard the work is performed by two men, and it is expected that the method may be simplified so that one man can work the entire apparatus.

Further technical details are given concerning the installation and upkeep of the pipes and hose and other points of interest.

Die Ausfuhr von Schädlingsbekämpfungs mitteln aus den Vereinigten Staaten im Jahre 1928. [The export of pest control preparations from the United States in the year 1928.]—*Chem. Indus.*, lii, 18, pp. 517–518, 1929.

According to information supplied by E. C. Taylor in *Commerce*

Reports, the total value of the various insecticides, fungicides, and household disinfectant preparations exported from the United States in 1928 amounted to $ 6,365,000, compared with approximately $ 5,100,000 in 1927—an increase of some 25 per cent. The value of the copper sulphate exported in 1928 was $ 455,023 as against $ 320,653 in 1927, an increase of 41·9 per cent. Of the total of $ 1,700,000, at which the American disinfectants imported into Europe were valued, copper sulphate was responsible for only $ 193. South America was the principal buyer in 1928, the total value of the disinfectants imported into the Argentine being estimated at $ 190,720, while the corresponding figures for Colombia, Chili, Venezuela, Uruguay, and Peru were $ 187,470, $ 126,900, $ 118,560, $ 95,300, and $ 94,140 respectively. The value of the copper sulphate exported to South America was placed at $ 205,934. Canada imported copper sulphate from the United States to the value of $ 107,000 and Mexico to that of $ 108,000, the amounts exported to Asia and Africa being estimated at $ 12,188 and $ 3,650, respectively. Similar figures are available in respect of various insecticides and household disinfectants.

CHAINE (E.). **L'action catalytique des bouillies cupriques.** [The catalytic action of cupric mixtures.]—*Prog. Agric. et Vitic.*, xci, 16, pp. 380–385, 1929.

The author states that in cupric mixtures [as used in the control of *Plasmopara viticola* on the vine] the actively destructive agent is invariably a basic copper salt; in Bordeaux mixture it is basic copper sulphate and in Burgundy mixture basic copper hydrocarbonate. Villedieu established that copper (like other metals such as nickel and calcium) acts not in solution but as insoluble compounds, basic copper oxide being the active agent [cf. *R.A.M.*, ii, p. 374; iv, pp. 230, 297].

Contact between the copper oxide and the zoospores is brought about on the leaf by means of the sulphate of lime or soda (referred to by Villedieu as 'mobilizing agents') which by reason of their solubility bring minute particles of copper oxide into the drops of spray. The toxic action of the mixture depends upon this contact being effected, and is, in the author's opinion, an example of catalysis, in which the copper oxide is the catalysing agent and the zoospores are destroyed by catalytic oxidation, the necessary oxygen being taken from the air. In catalytic oxidation the catalysing agent is probably always insoluble in the medium in which the oxidation is produced. The best catalysing agents are the metallic oxides, especially the basic oxides.

As catalysis takes place on the surface of the leaf, a catalysing agent will tend to be active in proportion to its tenuity, so that the ideal catalysing agent is a colloidal one. This colloidal state, or one approaching it, can only be brought about by precipitation in dilute liquids. If copper sulphate and carbonate of soda dusts are mixed and water is added, the precipitate is less tenuous than that obtained in dilute liquids, and acts more as if concentrated solutions had been used, because the dust molecules dissolve in the neighbouring molecules of water and are precipitated before being diluted in the mass of the fluid.

In order that the copper may be placed in suspension in the drops of spray, the mobilizing agent must be soluble enough to permit the progressive release of minute quantities of copper, but not soluble enough to prevent the deposit from retaining enough of it to mobilize the copper for the greatest possible length of time; in this respect sulphate of lime is excellent.

Not only is Bordeaux mixture that which most nearly approaches the ideal in regard to its mobilizing agent and the tenuity of the precipitate, but its basic copper sulphate is tetrabasic if the mixture is neutral and pentabasic if it is alkaline, containing in the former case 75 per cent., and in the latter 80 per cent. active copper, as compared with only 50 per cent. in Burgundy mixture.

Howard (F. L.). **Keeping up the strength of corrosive sublimate solutions.**—*Amer. Potato Journ.*, vi, 5, pp. 142–143, 1929.

Brief directions are given for the preparation of a potassium iodide solution for use in testing the maintenance of a correct strength of corrosive sublimate solutions (as employed in the treatment of seed potatoes against various diseases). The solution is composed of 5 gm. of potassium iodide dissolved in 1,000 c.c. of water, to which 2 tablespoonsful of dilute copper sulphate solution are added. A standard amount of this 0·5 per cent. iodide solution (10 c.c.) is poured into a cup, and a sample of the corrosive sublimate solution slowly added until a permanent uniformly orange-coloured precipitate is formed. If the corrosive sublimate solution is at a concentration of 1 in 1,000, it will require about 20 c.c. to induce this change.

Puchner (H.) & Fischer (W. E.). **Prüfung eines Beizapparates 'Saatglück' der Fa. K. Volger, Eisenach (Thür.).** [Trial of a disinfection apparatus 'Saatglück' manufactured by the firm of K. Volger, Eisenach (Thuringia).]—*Tech. Landw.*, x, 4, pp. 19–20, 1 diag., 1929.

Particulars are given of trials carried out with the 'Saatglück' seed-grain dust disinfection apparatus (K. Volger, Eisenach). Tillantin dust was used at the following rates: 100 gm. per cwt. against snow mould of rye (*Fusarium*) [*Calonectria graminicola*], wheat bunt [*Tilletia caries* and *T. foetens*], *Fusarium*, and plumed spore disease [*Dilophospora alopecuri*], [unspecified] diseases of leguminous crops, and *Fusarium* of flax [*F. lini*]; 200 gm. per cwt. against stripe disease and covered smut of barley [*Helminthosporium gramineum* and *Ustilago hordei*]; and 250 gm. per cwt. against loose and covered smut of oats [*U. avenae* and *U. kolleri*]. The apparatus was found to be simple to use and permitted a thorough and uniform distribution of the dust.

Veitch (R.) & Simmonds (J. H.). **Pests and diseases of Queensland fruit and vegetables.**—198 pp., 64 pl. (6 col.), Queensland Dept. of Agric. and Stock, 1929.

This useful handbook, illustrated with excellent original photographic and water colour plates and line drawings, comprises a brief survey of the available information with regard to the life-history, symptoms, etiology, and control of some of the commoner

pests and diseases of Queensland fruit and vegetables, together with a concise account of the rudiments of plant pathology and entomology. Certain sections of the text have been published in the *Queensland Agricultural Journal*, but the major portion has been specially prepared for the present work.

ASHBY (E.). **Plant pathology in schools.**—*School Science Rev.*, x, 38, pp. 110–118, 1928; 40, pp. 308–315, 2 figs., 2 diags., 1929.

Some useful practical suggestions are made regarding the introduction of plant pathology into the more advanced stages of the school curriculum in Great Britain. Notes are given on the material and apparatus required for elementary instruction, the methods and technique of the growing of organisms in artificial cultures, experimental work on the mode of growth and reaction to environmental conditions of various fungi, and the systematic study of disease. In the second part of the paper the application of these methods is illustrated by some well-known fungous diseases, and brief observations on wound reactions and on certain physiological disorders are given.

MORSTATT (H. M.). **Bibliographie der Pflanzenschutzliteratur: das Jahr 1928.** [Bibliography of plant protection literature for the year 1928.]—*Biol. Reichanst. für Land- und Forstwirtsch.*, Berlin-Dahlem, 251 pp., 1929.

This bibliography of German and foreign literature published in 1928 on various aspects of plant pathology and plant protection has been prepared on the lines adopted in previous years [*R.A.M.*, vii, p. 657].

Discussion on 'ultra-microscopic viruses infecting animals and plants'.—*Proc. Roy. Soc. London*, Ser. B, civ, 733, pp. 537–560, 1929.

This discussion at the Royal Society, London, on the origin, nature, and activities of ultra-microscopic viruses was opened by Sir Charles Martin and Prof. P. A. Murphy, representing the animal and plant aspects of the subject, respectively. Their contributions towards defining the present position of knowledge of the many problems involved were followed by a number of others from workers in both fields.

DAVIS (E. F.). **Some chemical and physiological studies on the nature and transmission of 'infectious chlorosis' in variegated plants.**—*Ann. Missouri Bot. Gard.*, xvi, 2, pp. 145–213, 11 pl., 6 graphs, 1929.

A full review is given of previous literature on infectious chlorosis in variegated plants [*R.A.M.*, vii, p. 385], the writer's recent investigation of which was directed towards the following objects. (1) Origin of the chlorotic areas under the various conditions of light intensity and quality, length of day, and concentration of carbon dioxide. (2) Nature of the cellular changes of the green and variegated tissues of leaves kept under the abovementioned conditions, determined (*a*) by histological examinations

of living and fixed leaf material, (*b*) by the determination of hydrogen-ion concentrations by the quin-hydrone electrode and indicator methods [the technique of which is explained and the resulting data tabulated], and (*c*) by the analysis for total acidity by electrometric titrations.

Baur's observations (*Ber. Deutsch. Bot. Gesellsch.*, xxiv, p. 416, 1906) concerning the effects of the quality of light on certain plants suffering from infectious chlorosis could not be confirmed in the case of *Euonymus japonica* var. *aurea*. While the leaves of *Abutilon thompsoni* turned uniformly green during five months' exposure to sunlight deficient in blue rays under one set of conditions, and green rays under another, the author is inclined to attribute these effects partially or entirely to the shade produced under Corning's glasses, Noviol 'C' and G 34. Two months' continuous illumination by light closely approximating to sunlight in intensity failed to modify appreciably the typical variegated appearances of *A. thompsoni* and *E. japonica* vars. *aurea* and *medio-picta*, as compared with similar plants kept under the ordinary greenhouse conditions for the same length of time. *A. thompsoni* plants receiving short exposures to artificial light under controlled conditions, so as to represent five- and seven-hour days, for a period of two months, were observed to develop new leaves with a progressively more uniform, and ultimately complete green tinge, whereas when the periods of alternate light and darkness were 12 hours each the foliage remained brightly variegated. *A. thompsoni* plants kept in total darkness for varying periods from a few days to a fortnight, during which time the stems lost all the mature leaves, showed no trace of variegation in the new foliage formed while the plants were in obscurity and subsequently matured in the light. On the other hand, variegation occurred in the leaves developing after the plants were restored to the light.

Little contrasting differentiation was shown by an examination of fixed and stained sections of areas transitional between the green and chlorotic regions of markedly variegated leaves of *A. thompsoni*, which were further entirely devoid of vacuolate or X-bodies. The two cases of variegation in *E. japonica* studied by Miss F. F. Smith [ibid., vi, p. 432] were not proved by her to be infectious, and the presence in them of vacuolate bodies is no evidence that these bodies occur in the true infectious chloroses.

Negative results were given by all experiments in the transmission of infectious chloroses by methods other than grafting. Successful transmission was obtained by grafting and budding *E. japonica* var. *aurea* with the green variety.

By stripping off successive crops of variegated leaves, *A. thompsoni* plants were induced to develop uniformly green foliage, thus substantiating Baur's results [loc. cit.].

The data obtained in the above-mentioned electrometric determinations showed that the chlorotic areas of two of the mottled varieties of *E. japonica*, i. e., *argentea* and *medio-picta*, were higher in initial acidity than the green areas; this was not the case, however, with *aurea*. Freezing the leaves before expressing the juice was found to cause an increase in the buffer action of the

juices from the green and mottled varieties of *Euonymus*. There was a marked increase of total acidity in samples from the leaves of the green variety and from the green areas of the variegated foliage, but not in samples from chlorotic areas, after exposure of the expressed juice to the air for four to twelve hours.

McDougall (W. B.) & Glasgow (Olalla E.). **Mycorrhizas of the Compositae.**—*Amer. Journ. of Botany*, xvi, 4, pp. 224–228, 3 figs., 1929.

During the winter of 1927–8 the roots of 33 species, distributed among 19 genera of the Compositae growing in the vicinity of Urbana, Illinois, were examined microscopically for the presence of mycorrhizal fungi [cf. *R.A.M.*, viii, p. 190]. Endotrophic mycorrhiza were found in 28 of the species (84·8 per cent.) and 17 of the genera (89·4 per cent.). The endophytic mycelium in the Compositae was found to consist of relatively large, sparsely ramified, non-septate hyphae. Terminal hyphal swellings, which the authors regard as arbuscules, were found in five species, viz., *Lactuca scariola*, *Liatris pycnostachya*, *Eupatorium urticaefolium*, *Aster cordifolius*, and *Taraxacum officinale*, and a sporangiole in one, *Silphium laciniatum*. The authors incline to the view that the mycorrhiza of the Compositae are merely harmless root parasites which exercise no beneficial action on the higher symbionts.

Rivera (V.). **Cicatrizzazioni sperimentali di fusto di 'Ricinus communis' determinate da 'Pseudomonas fluorescens' (Flügge) Migula.** [Experimental cicatrizations of the stem of *Ricinus communis* produced by *Pseudomonas fluorescens* (Flügge) Migula.]—*Rendic. Accad. Lincei*, Ser. 6, ix, 6, pp. 510–512, 1 pl., 1929.

When the stems of growing *Ricinus communis* plants were wounded aseptically in two places and a pure culture of *Pseudomonas* [*Bacterium*] *fluorescens* was inserted in the wounds (other *R. communis* plants being similarly wounded but not inoculated) it was subsequently observed that whereas the cuts in the control plants failed to heal, the wounds in the inoculated plants became swollen at the edges and closed up from a voluminous development of callus. In the uninoculated plants a semicircle of new tissue, composed chiefly of supporting fibres and tracheids, developed from the central cylinder, but it was of limited growth and failed to close the wound. In the inoculated stems a cellular proliferation of an altogether different kind took place, which caused the edges of the wound to unite, the anatomical structure of this new formation resembling that commonly noted in the cicatrization of wounded stems exposed to the air. It is concluded that the normal process of healing by callus formation may be due to the presence of bacteria from the air or soil, which stimulate cellular activity and lead to the formation of a defensive tissue of cicatrization.

Köck [G.]. **Ausbreitung des Kartoffelkrebses in Polen.** [Extension of Potato wart in Poland.]—*Oesterr. Zeitschr. für Kartoffelbau, 1929*, i, pp. 30–31, 1929.

According to the *Landw. Zentral-Wochenbl. für Polen*, 50, 1928,

the incidence of potato wart [*Synchytrium endobioticum*] is steadily increasing in Poland, especially in Silesia, where 94 centres of infection out of a total of 137 for the country have been reported. An Order of the Polish Ministry of Agriculture, dated 9th February, 1928, prohibits the movement of potatoes from the infested and adjacent areas and restricts the issue of export certificates to consignments of potatoes grown at the regulation distance from the nearest point of infection. Austrian growers are warned to use the utmost caution in the purchase of Polish potatoes [cf. *R.A.M.*, viii, p. 261].

Die Kartoffelkrebsbekämpfung im Freistaate Sachsen. [Potato wart control in the Saxon Free State.]—*Merkbl. Sächs. Pflanzenschutzgesellsch. Dresden*, 8, 6 pp., 1929. (Supplement to *Die Kranke Pflanze*, vi, 4, 1929.)

In view of the increasing prevalence of potato wart (*Synchytrium endobioticum*) in the Saxon Free State, an Order (effective as from 1st January, 1929) has been promulgated containing the following (among other) provisions. All land planted with potatoes and all stocks of potatoes are subject to official inspection. The presence of wart disease on planted or stored potatoes must immediately be notified to the municipal authorities, and all infected material destroyed by burning, the ashes being buried at least 1 m. deep. Potatoes must not be planted on infected sites until a period of at least 10 years has elapsed since the detection of wart disease. For 8 years after the detection of wart disease only wart-immune varieties may be planted on sites contiguous to the infected areas.

K[öck (G.)]. **Kartoffeleinfuhr nach der tschechoslowakischen Republik im Jahre 1929.** [Importation of Potatoes into the Czecho-Slovakian Republic in the year 1929.]—*Oesterr. Zeitschr. für Kartoffelbau, 1929*, 1, p. 31, 1929.

In pursuance of a recent Order, the unrestricted importation of potatoes into Czecho-Slovakia will be permitted during 1929 only from Esthonia, Italy, Jugo-Slavia, and Hungary. In exceptional cases permission may be granted by the Ministry of Agriculture for the importation of potatoes from Holland, Germany, Poland, and Austria.

Janssen (J. J.). **Invloed der bemesting op de gezondheid van de Aardappel.** [Influence of fertilizing on the health of the Potato.]—*Tijdschr. over Plantenziekten*, xxxv, 5, pp. 119–151, 1 pl., 1929. [German summary.]

In this paper [to which an introduction is contributed by Prof. H. M. Quanjer], the author fully describes his experiments, conducted on heavy clay and poor sandy soil at Wageningen, to determine the effect of various fertilizers on the health of the potato crop. Six plots were treated as follows: (1) complete fertilizer, consisting of 800 kg. ammonium sulphate, 200 kg. Chile saltpetre, 900 kg. superphosphate, and 1,000 kg. patent potash; (2) as in (1) but with half the quantity of potash; (3) as in (1) but with no

potash; (4) as in (1) but without phosphoric acid; (5) as in (1) but with half the quantity of nitrogen; and (6) as in (1) but with no nitrogen. Healthy plants were interspersed with individuals suffering from mosaic.

It was found that the tubers of plants deprived of phosphorus were more susceptible to infection by *Phytophthora infestans*, while those receiving no nitrogen or potash readily succumbed to *Rhizoctonia* [*Corticium*] *solani*. The lowest incidence of mosaic was found almost uniformly among the plants receiving reduced quantities of nitrogen or none, and the highest in the plots deprived of potash. In a similar test, using leaf roll plants as the source of infection, the resistance of individuals in the reduced nitrogen plots was even more conspicuous, but the connexion between potash deficiency and susceptibility was less apparent. The presence of a few diseased plants in the field may give rise to infection (which rapidly spreads to the tubers) at an early date (by 5th July). The Thorbecke variety proved highly resistant to mosaic, but it was more susceptible to leaf roll than the other three used in the tests, viz., Eigenheimer, Roode Star, and Industrie (of which the first-named was highly susceptible to mosaic) [cf. *R.A.M.*, viii, p. 331].

In greenhouse experiments, conducted under controlled conditions, the leaf roll virus reached the tubers of plants receiving heavy supplies of nitrogen in 12 days in 8 cases out of 12, whereas infection was greatly retarded or even prevented in the reduced nitrogen plots. The aphid vectors developed most profusely on plants receiving no potash and least on those receiving no nitrogen. They were found in greater numbers on plants infected by mosaic and leaf roll than on healthy ones. There were indications that the relative richness in sugar of potash-deficient and leaf roll plants might explain the preference of the aphids for these plants.

Anatomical investigations showed that the cuticle of the plants receiving reduced quantities of nitrogen was thicker than normal and their secondary tissues, sclerenchyma and wood, were formed more rapidly.

HARTER (L. L.) & WEIMER (J. L.). **A monographic study of Sweet Potato diseases and their control.**—*U.S. Dept. of Agric. Tech. Bull.* 99, 117 pp., 26 pl., 23 figs., 1 map, 1929.

This is a very comprehensive account of the fungous and physiological diseases of sweet potatoes in the field and in storage, with observations on their distribution, severity, etiology, and control. Notes are also given on the origin of the sweet potato, its cultivation, the losses due to disease in the United States, and the proper methods of storage.

A ten-page bibliography is appended.

MARTIN (T. L.). **The effect of Sweet Clover and Alfalfa roots and tops on the fungous flora of the soil.**—*Soil Sci.*, xxvii, 5, pp. 399–405, 1 graph, 1929.

The addition to a clay loam sub-soil (below the top two inches)

of one per cent. of lucerne and sweet clover [*Melilotus alba*] roots or tops, was found in pot experiments to increase the numbers and influence the types of moulds developing in the soil. The chief fungi encountered were species of *Mucor*, *Penicillium*, and *Monilia*, the first-named growing so vigorously in the early stages (up to 3 weeks) that it was impossible to make accurate counts of the other genera. Plates were poured at fortnightly intervals up to 10 weeks, and the relative numbers of the different genera in each of the four treatments and in the controls are shown in a graph. The more succulent the material, the greater is the stimulus afforded to the development of *Mucor* spp. The lucerne and sweet clover root incorporations were not found to influence development as much as the corresponding tops, but the roots increase the number of *Penicillium* spp. more than the tops. *Mucor* spp. grew more rapidly in soil containing either tops or roots of sweet clover than with incorporations of the corresponding organs of lucerne, but the reverse was the case with *Monilia* spp. *Penicillium* preponderated in the soil receiving clover roots at all periods of the experiments. The addition of lucerne to the soil was shown to increase the variety of moulds as compared with the incorporation of sweet clover, and in general, the total number of colonies was greater in lucerne than in the sweet clover treated soils. After 35 days, or after the subsidence of the vigorous *Mucor* growth following the incorporation of the tops, the total number of mould colonies is larger in soils treated with roots than in those receiving either lucerne or sweet clover tops, this being largely due to the preponderance of *Penicillium*.

Bureau of Sugar Experiment Stations. Cane pests and diseases. —*Queensland Agric. Journ.*, xxxi, 5, pp. 336–337, 1929.

In the Lower Burdekin area of Queensland downy mildew or leaf stripe [*Sclerospora sacchari*] is the most important disease of sugar-cane and is responsible for the gradual disappearance of B. 208, though when healthy this variety gives such heavy yields that every effort should be made to save it. In this area, where the winters are dry and very few ratoons are grown, it is considered that *S. sacchari* may be controlled by rejecting any cane as seed if within 200 yards of any diseased cane, and uprooting diseased plants immediately. Mosaic is the chief disease in the Farleigh area and is serious also in the vicinity of Bauple. The resistant P.O.J. varieties, 234, 36, and 213, have not shown sufficient promise under Queensland conditions to warrant propagation. North of Townsville, top rot [*R.A.M.*, vii, p. 600] has become more common; observations, however, indicated that a vigorous, well-grown crop is likely to remain unaffected. An exhaustive survey of the Bundaberg district showed some 40 more or less isolated farms to be free from gumming [*Bacterium vascularum*] on three successive inspections; after further visits a list of farms considered safe as sources of seed will be published.

The necessity for the quarantine of sugar-cane varieties introduced into Australia is emphasized by the fact that the Brandes

collection of New Guinea canes now growing in Sydney [ibid., viii, p. 133] already shows both mosaic and Fiji disease [*Northiella sacchari*].

STAHL (C. F.) & FARIS (J. A.). **Behaviour of the new P.O.J. Canes toward mosaic.**—*Trop. Plant Res. Foundation Bull.* 9, 12 pp., 2 figs., 2 diags., 1929.

In order to obtain comparative data on the relative susceptibility of sugar-cane varieties to mosaic, a number of P.O.J. and other canes were planted in alternate rows with Cristalina grown from mosaic-infected setts in Cuba. The results [which are tabulated] showed that the P.O.J. 2714, 2725, and 2727 varieties may be considered commercially immune (7, 14·8, and 18·3 per cent. mosaic after seven months compared with 100 per cent. in P.O.J. 100, 96·8 in P.O.J. 228, 97·1 in P.O.J. 36 and Co. 213, 96·9 in B.H. 10 (12), 85 in Co. 281, 80 in P.O.J. 2883, and 75 in Cristalina). Even when attacked, the three highly resistant varieties suffer little damage, and a tendency towards recovery was shown by P.O.J. 2714 and 2725 [*R.A.M.*, viii, pp. 61, 402, 403].

In a further test, young sprouts 3 to 6 inches high were exposed to attack by *Aphis maidis* fed for two days previously on mosaic-infected cane. P.O.J. 2714, 2725, and 2727 again proved highly resistant (8·6, 26·6, and 8·3 per cent. infection, respectively, compared with 100 per cent. in P.O.J. 2883, 84·6 in Badila, 77·7 in P.O.J. 36, 77·5 in Cristalina, and 68·4 in B.H. 10 (12)). None of the 7 sprouts of P.O.J. 2878 used in the test contracted mosaic, and this variety is therefore believed to be immune.

DAVIS (R. L.). **P.O.J. 2878 in Porto Rico.**—*Sugar News*, x, 5, pp. 342–343, 1929.

The behaviour of the P.O.J. 2878 variety of sugar-cane in Porto Rico is stated to be extremely satisfactory. Since its importation direct from Java in March, 1927, P.O.J. 2878 has shown virtual immunity from mosaic [see preceding abstract], and its 'wild blood' also confers a high degree of resistance to other diseases [cf. *R.A.M.*, viii, p. 133].

COSTANTIN (J.). **L'emploi des hybrides javanais de la Canne à sucre contre le séreh et la mosaïque.** [The use of Java Sugar-Cane hybrids for the control of sereh and mosaic diseases.]—*Rev. de Bot. Appliquée*, ix, 93, pp. 229–240, 1929.

In this note the author reviews the work done since its inception to the present time in the hybridization of sugar-canes in Java, with particular reference to the relative resistance to the sereh disease and to mosaic of the hybrids thus obtained. Most of his information is drawn from a recent paper by J. Jeswiet, entitled 'History of Sugar-Cane selection work in Java' (*Planter and Sugar Manufacturer*, lxxx, 5, p. 81, 1928), but reference is also made to the older literature, a short bibliography of which is appended. In giving a detailed description of the parentage of a number of hybrids (among which are included some of the more

important Java canes, e.g., P.O.J. 2878, 2725, 36, 213, and 234), he tries to show that the success attained by these hybrids from the point of view of commercial, if not absolute, control of the two diseases is mainly due to the influence of a parent of alpine origin, thus supporting his view expressed in a previous paper [*R.A.M.*, vii, p. 403] that virus diseases of plants are amenable to the 'cure by altitude'.

ABBOTT (E. V.) & WOLCOTT (G. N.). **Mosaic of Sugar-Cane in Peru.**—*Science*, N.S., lxix, 1788, p. 381, 1929.

The presence of mosaic on sugar-cane has recently been detected in the Carabayllo Valley, near Lima, Peru, where infection ranges from 1 to 15 per cent. (over 90 per cent. in one plantation where the cultivation of this crop is to be discontinued). The affected varieties include Bourbon or white, Louisiana Purple, and some of the Barbados canes. The disease is believed to have been introduced from the Argentine Republic about eight years ago.

The maize aphid, *Aphis maidis*, has been observed on various grasses in the cane fields in all parts of Peru, as well as on *Arundo donax*, which is commonly found growing along ditches in the plantations. The ubiquity of this insect, the known vector of sugar-cane mosaic [*R.A.M.*, vi, pp. 318, 319, *et passim*], emphasizes the need for the prompt elimination of all infected stools, and the inadequacy of the regulations, already in force on some plantations, against maize growing. The individuals primarily responsible for the transmission of sugar-cane mosaic are those occurring, not on maize, but on grasses in the cane fields. During the hoeing and cultivation of the young cane these grasses are destroyed, with the result that the aphids seek nourishment on the sugar-canes.

FARIS (J. A.). **Some pathological effects of the mosaic disease of Sugar Cane.**—*Planter and Sugar Manufacturer*, lxxxii, 21, pp. 404–405, 1929.

During 1925 a comparative planting from healthy and mosaic sugar-cane in Cuba showed that the mosaic cane had a very high proportion of dead stalks with dry tops, in marked contrast to the healthy cane, which was on exactly similar soil. As the tops and leaf areas in the mosaic cane were much less than in the healthy cane it was suspected that the mosaic disease was also dwarfing the root systems. In this connexion it was noted that root disease [cf. *R.A.M.*, vii, p. 118] was most prevalent in mosaic areas. Growers also agreed that healthy plants were more difficult to plough up than diseased ones.

Pot experiments [details of which are given] with healthy and mosaic B.H. 10 (12) and Cristalina showed that although at the end of the second and third months the dry weight of the mosaic Cristalina cane was only 47 and 33·3 per cent., respectively, of that of the healthy cane, after six months it had risen to be 89 per cent.; in the author's opinion there is some indication that Cristalina under conditions of optimum water supply can to some extent recover from early mosaic. In the case of the B.H. 10 (12) the

weight of the mosaic cane was about 50 per cent. that of the healthy throughout the experiment. These results confirm field observations that under conditions of abundant moisture supply B.H. 10 (12) gives much heavier tonnage than Cristalina, provided both are healthy; if both have mosaic, Cristalina seems to give the better yield. As, however, B.H. 10 (12) is very susceptible to mosaic, its planting may be attended with risks in those wet regions where it should be superior to Cristalina.

In an experimental field in Oriente Province where the cane suffers greatly from root trouble owing to a heavy clay soil and the normally very wet summer followed by drought, 576 plants of Cristalina cane were planted from healthy 'seed'. As the surrounding fields were severely affected with mosaic, 117 plants contracted the disease in six months; of the 459 healthy plants 189, or 41 per cent., died, while of the diseased remainder 87, or 74·4 per cent., died. Field counts in badly affected areas gave similar results, missing hills being more frequent in fields of mosaic cane than in healthy ones. It was also noted that mosaic plants produced fewer tillers than healthy plants, entailing very serious loss.

These observations indicate that mosaic plants die out more rapidly than healthy ones, owing to a dwarfed root system, that reduced yields are obtained even where the mosaic cane appears as large as the healthy cane, owing to the poorer tillering of the former, and that when prolonged drought is experienced it is very dangerous to have mosaic fields, even though under normal rainfall conditions they give adequate yields.

Cook (M. T.). **The gummosis of Sugar Cane. (Second paper).**—*Journ. Dept. Agric. Porto Rico,* xiii, 1, pp. 72–76, 1929.

In continuation of his previous paper on sugar-cane gummosis [*Bacterium vascularum*] in Porto Rico [*R.A.M.*, viii, p. 463], the author states that all the evidence collected indicates that the planting of infected cane will give losses in the first crop in proportion to the amount of infection in the seed, the relative resistance of the variety, and the weather conditions during the growing season. In the production of the second crop (1st ratoon) many of the underground parts of the canes die as a result of the disease, as well as a large proportion of the new shoots, this proportion becoming even larger during the next year (2nd ratoon crop). This partly explains the frequently observed fact that ratoon crops show a lower percentage of infection when mature than new plantings, as most of the infected canes die before ripening. On the whole, the author believes that gummosis is a diminishing factor in Porto Rico owing to the extended growth of resistant varieties, but must still be reckoned with in developing or introducing new desirable but possibly susceptible varieties of cane.

North (D. S.). **Leaf scald disease of Sugar-Cane and its control.** —*Australian Sugar Journ.*, xxi, 2, pp. 99–110; 3, pp. 169–183, 22 figs., 1 col. pl., 1929.

This is a condensed version, in semi-popular terms, of the

author's technical paper (now out of print) on leaf scald of sugar-cane [*Bacterium albilineans*: *R.A.M.*, viii, p. 466], which has already been noticed [ibid., vi, p. 120].

HENARES (H. G.) & AURELIO (C. G.). **The effect of diseased Cane on the Java ratio.**—*Sugar News*, x, 5, pp. 329–334, 2 figs., 1929.

An investigation has been carried out by the Isabela Sugar Company, Inc., Philippine Sugar Central, to ascertain the causes of the low sucrose content of Luzon White, Negros Purple, and Badila canes after milling. Special attention was paid to the variations in the 'Java ratio', which is defined as

$$\frac{\text{sucrose per cent. cane}}{\text{pol. per cent. first expressed juice.}}$$

The results of bagasse and juice analyses [which are tabulated] indicated that the recent drop in the Java ratio from 83·31 during the past milling season to below 80 is due to the extensive infection of the canes by pineapple disease (*Thielaviopsis paradoxa*). According to a statement made by H. A. Lee in correspondence with the manager of the Sugar Central, weather conditions during the current season have been particularly favourable for the development of this fungus.

PRIODE (C. N.). **Pokkah-bong and twisted top diseases of Sugar-Cane in Cuba.**—*Phytopath.*, xix, 4, pp. 343–366, 1 col. pl., 11 figs., 1929.

A full account is given of the symptoms of pokkah boeng and twisted top of sugar-cane in Cuba [*R.A.M.*, viii, p. 337], and of the inoculation experiments which proved them to be separate diseases, the only symptom common to both being the twisting of the tops. Pokkah boeng was shown to be an infectious disease, probably identical with that occurring in Java and Louisiana [ibid., vi, p. 642; vii, p. 537], caused by a species of *Fusarium* closely resembling *F. moniliforme* [*Gibberella moniliformis*]. Twisted top, on the other hand, is a non-infectious disease, probably identical with the form of pokkah boeng reported from Hawaii (*Hawaiian Planters' Record*, xxxii, p. 41, 1928), and due to a purely mechanical friction of the leaves. Most of the cane varieties grown commercially in Cuba are more or less susceptible to pokkah boeng, especially P.O.J. 2878, but the resulting damage is inconsiderable. [This paper is reprinted as *Tropical Plant Research Foundation, Scientific Contribution* 14, 1929.]

PARISI (R[OSA]). **Micromiceti di Libia raccolti dal Prof. Cavara.** [Micromycetes of Lybia collected by Prof. Cavara.]—*Bull. Orto Bot. Napoli*, ix, 1, pp. 55–67, 1928.

This is a list of 78 fungi collected in Lybia by Prof. Cavara, of the Naples Botanic Garden, a considerable number being parasitic on cultivated plants.

BUCHHEIM (A.). **Infektionsversuche mit Erysiphe polygoni auf Caragana arborescens Lam.** [Inoculation experiments with *Erysiphe polygoni* on *Caragana arborescens* Lam.]—*Ber. Deutsch. Bot. Gesellsch.*, xlvii, 4, pp. 226–229, 1 fig., 1929.

Continuing his inoculation experiments with *Erysiphe polygoni* from *Caragana arborescens* on a number of hosts [which are enumerated: *R.A.M.*, viii, p. 67], the writer found that, in addition to eight other species of *Caragana*, *Robinia pseud-acacia* was the only plant infected by this strain. The average perithecial dimensions of two strains of *E. polygoni* from *R. pseud-acacia* were 95 to 101 and 88 to 111 μ, respectively, and from *C. arborescens* 94 to 115 and 93 to 113 μ.

The International Convention of Plant Protection (Rome, 16 April, 1929).—*Internat. Bull. of Plant Protect.*, iii, 4, pp. 50–55, 1929.

At the International Diplomatic Conference for Plant Protection, opened in Rome on 16th April, 1929, the representatives of the contracting countries [which are enumerated] agreed, subject to ratification, to adopt the legislative and administrative measures necessary to secure common and effective action against the introduction and spread of plant diseases and pests. Such measures should be specially directed towards (1) the supervision of areas under cultivation, nurseries, gardens, greenhouses, and other establishments supplying the trade with plants and parts thereof, lists of which will be periodically prepared by each of the contracting countries; (2) the notification of the appearance of plant diseases and pests and the specification of the districts affected; (3) the means of prevention and control of plant diseases and pests; (4) the regulation of all kinds of transport and packing of plants in order to prevent the use of any material liable to spread diseases or pests; and (5) the establishment of penalties for infringement of the prescribed regulations.

Each country adhering to the present Convention will establish an official plant protection service to execute the measures indicated above, including in its scope the foundation of an institute for scientific, technical, and applied research and investigation in microbiology and agricultural pathology and zoology; and further, a special branch of the above, responsible more particularly for the inspection of areas under cultivation, the distribution of information regarding plant diseases and their control, the inspection of plant consignments, and the issue of phytosanitary certificates, &c. The health certificates should conform to the model attached to the present Convention, and the cases in which such certificates are required should be reduced within the strictest limits compatible with the safeguarding of the crops of each country.

The contracting countries agree to take all necessary steps for the prevention and control of plant diseases and for the supervision of imports, especially of those from countries which are still without official plant protection services. Each country reserves its right of inspection and quarantine of plants, and (in exceptional cases) of prohibition of importation, even where the consignments are

accompanied by health certificates. Reasons for such a measure should be declared, and should be based only on the genuine necessity of protecting home crops against infection by diseases or pests known to be present in the country dispatching the consignments. In cases of disagreement regarding the interpretation of this or other clauses of the Convention or if a country wishes to challenge the prohibition of imports coming from its territory, the International Institute of Agriculture may be approached with a view to bringing about a settlement. For this purpose arbitration by a technical committee of experts appointed by each of the States concerned and by the Institute will be carried out and a report submitted by the Institute to the countries concerned, complete liberty as to further action being reserved to the Governments. The contracting countries are requested to ratify the Convention at the earliest possible date.

McCubbin (W. A.). **Plant quarantines and the State.**—*Phytopath.*, xix, 5, pp. 487–492, 1929.

In this paper the author defines the functions of the State and Federal authorities in relation to the plant quarantine organization in the United States, and describes the establishment of four regional Plant Boards.

Legislative and administrative measures. Poland.—*Internat. Bull. of Plant Protect.*, iii, 5, p. 70, 1929.

By a Decree of 31st July, 1928, the Polish Ministry of Agriculture has ordered the destruction of all barberry bushes (other than those in Botanic Gardens or in woods, at a distance exceeding 200 m. from the edges) before 1st May, 1929, throughout the Republic, except in Silesia.

Quarantine on account of the phony Peach disease. Notice of Quarantine No. 67.—*U.S. Dept. of Agric., Plant Quarantine and Control Admin. Leaflet*, 4 pp., 1929.

In order to prevent the spread of the phony disease of peaches [*R.A.M.*, viii, p. 388], certain regulated areas [which are listed] of the States of Georgia and Alabama are placed in quarantine as from 1st June, 1929. After that date no peach or nectarine trees or roots, or any variety of tree or shrub grafted on such roots, may be moved from the specified areas to any other part of the United States, except under a special permit of the Department of Agriculture issued in favour of stock originating in nurseries in which, and within one mile of which, the phony disease has not been present for at least two years (or during a single season in the case of consignments dispatched before 1st July, 1930) prior to the proposed date of movement.

Legislative and administrative measures Argentina.—*Internat. Bull. of Plant Protect.*, iii, 4, p. 56, 1929.

A Decree of the Argentine Ministry of Agriculture, dated 28th August, 1928, prohibits the importation into the Republic of banana plants or shoots, in order to protect the plantations against infection by *Fusarium cubense* and other diseases.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

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YOSSIFOVITCH (M.). **Le mécanisme de la séparation des périthèces chez les Érysiphacées et le rôle des fulcres.** [The mechanism of detachment of perithecia in the Erysiphaceae and the part played by the fulcra.]—*Rev. Path. Vég. et Ent. Agric.*, xvi, 4–5, pp. 132–140, 1929.

In this note the author briefly refers to experiments made by him in 1927 in Jugo-Slavia, in which perithecia of seven species of Erysiphaceae belonging to the genera *Uncinula*, *Microsphaera*, and *Podosphaera* [a list of which is given], attached to the leaves of their respective hosts, were subjected to desiccation either by strong air currents or by the action of the sun. In all these species the appendages of the perithecia are normally free and directed away from the leaf surface. In no case were the perithecia detached from their substratum on drying, nor were they loosened from the latter by winds reaching gale force. On the other hand, when subjected to the action of dripping or running water, comparable to rain, the perithecia were more or less speedily detached and borne away by the water, and then, as the water evaporated, again became firmly fixed to the substratum, this time by the appendages which, under the influence of moisture, became strongly recurved towards the under side of the perithecium and stuck to any surface with which they came into contact as they dried out. When again moistened they once more became detached. *Uncinula aceris* was the only species tested in which the appendages did not become recurved when moist, and in this species only such perithecia as were reversed stuck to the leaves on drying. These results contradict Neger's views (*Zeitschr. für Pflanzenkrankh.*, xi, p. 207, 1901) on the mechanism of detachment of the perithecia of these fungi, and show that they have a strictly limited dispersion, chiefly in a vertical direction downwards.

YOSSIFOVITCH (M.). **Sur le mécanisme de la séparation des périthèces chez des Érysiphacées et le rôle des fulcres.** [Note on the mechanism of detachment of the perithecia in some Erysiphaceae and the part played by the fulcra.]—*Comptes rendus Acad. des Sciences*, clxxxviii, 16, pp. 1056–1057, 1929.

This is a condensed version of the author's paper on the same subject which has been noticed from another source [see preceding abstract].

THOMPSON (A.). **Phytophthora species in Malaya.**—*Malayan Agric. Journ.*, xvii, 3–4, pp. 53–100, 3 pl., 4 graphs, 1929.

A detailed account is given of the author's further studies of local species and strains of *Phytophthora* in Malaya [cf. *R.A.M.*, vii, p. 539] and of comparative studies of certain allied strains from other countries. The results may be briefly summarized as follows.

Three species of *Phytophthora* are directly responsible for black stripe disease of *Hevea* rubber in Malaya; these are *P. palmivora* (rubber group) [ibid., viii, p. 527], *P. meadii*, and a new species which is named *P. heveae* with a diagnosis in English. In the last-named, no aerial mycelium is present, and the oogonia, the mean diameter of which is 25·91 μ, are broadly funnel-shaped with amphigynous antheridia; measurements of the spherical to narrow-ovate, irregular sporangia on agar media gave a mean length of 45·49 μ and a mean width of 29·62 μ, with a ratio of length to width of 1·55. Their stalk is often laterally inserted. The numerous round, smooth, thick-walled oospores have a mean diameter of 21·46 μ. No true chlamydospores were found.

P. palmivora (rubber group), a *Pythium* species thought to be *P. complectens* [ibid., iv, p. 286], and an unnamed species of *Phytophthora* are all direct causes of patch canker of *Hevea* rubber. The unnamed *Phytophthora* is characterized by regularly shaped sporangia, most of which are broadly ovate and have prominent papillae. The sporangiophore is usually basal, and part of it may remain attached to the free sporangium. No definite chlamydospores were noted, but circular sporangium-like forms developed, some of which had papillae, and measured from 27 to 42 μ in diameter. Measurements of sporangia (other than the circular forms without papillae) gave a mean length of 43·28 μ and a mean width of 30·04 μ. Oospores were not formed in pure culture.

P. heveae Thompson and *Pythium* (?) *complectens* were proved to be direct causes of pod rot of *Hevea* rubber in Malaya.

Certain other species of *Phytophthora* isolated from hosts other than *Hevea* rubber were also found capable of causing black stripe or patch canker of *Hevea* when inoculated into the bark; these (which for purposes of convenience are numbered) are no. 11, *P. palmivora* (cacao group) isolated in India from bud rot of coconut; no. 14, *Phytophthora* sp. isolated in India from a disease of *Piper betle*; no. 18, *P. palmivora* (rubber group) isolated in Jamaica from coco-nut; no. 19, *P. palmivora* (rubber group) isolated in St. Vincent from a disease of cotton; no. 13, *P. parasitica*, isolated in India from a disease of *Ricinus communis*; no. 16, *P. parasitica* (*P. nicotianae*) [ibid., vii, p. 601] isolated in Sumatra from a disease of tobacco; and no. 8, *P. parasitica*, isolated in Malaya from a disease of roselle fibre (*Hibiscus sabdariffa* var. *altissima*) and on morphological grounds belonging, with nos. 13 and 16, to the *Macrospora* section of this species [loc. cit.].

Evidence obtained from mixed cultures showed that nos. 13 and 16 both formed oospores when grown mixed with *P. palmivora* strains of the cacao group, but did not form them when mixed with members of the rubber group, neither were oospores formed

when nos. 13 and 16 were mixed together, these facts indicating that *P. parasitica* and *P. nicotianae* are of the same biologic strain. No. 8 did not form oospores in single spore culture and can be regarded as an atypical member [ibid., viii, p. 526] of the cacao group of *P. palmivora*. If so, then it would seem that the three fungi, nos. 13, 16, and 8, might all be referred to *P. palmivora*. They can, however, all be referred also to *P. parasitica* Dast., nos. 16 and 8 being similar to the type species which came from India (no. 13). Also, it may be that *P. parasitica* Dast. can develop homothallic and heterothallic strains, of which the latter may be regarded as atypical members of one or other of the two groups, rubber and cacao, of *P. palmivora*.

The fungus causing the disease of *Piper betle* previously reported at Pekan [ibid., v, p. 383] was identified by Ashby at the Imperial Bureau of Mycology as *P. colocasiae*. Oospores were formed when the fungus was grown in culture in England but were not formed in Malaya.

BLOCHWITZ (A.). **Die Aspergillaceen. System und Phylogenie.** [The Aspergillaceae. System and phylogeny.]—*Ann. Mycol.*, xxvii, 3–4, pp. 185–204, 1 pl., 1929.

The phylogeny of the Aspergillaceae (comprising the genera *Aspergillus*, *Citromyces*, and *Penicillium*) is traced, and their systematic position defined on the basis of morphological and physiological characters, with special reference to pigmentation [*R.A.M.*, viii, p. 326].

BLOCHWITZ (A.). **Die Gattung Aspergillus. Neue Species. Diagnosen. Synonyme.** [The genus *Aspergillus*. New species. Diagnoses. Synonyms.]—*Ann. Mycol.*, xxvii, 3–4, pp. 205–240, 1 pl., 13 figs., 1929.

Four new species of *Aspergillus* are listed, with diagnoses in German, viz., *A. galeritus* [*R.A.M.*, viii, p. 379], found on freshly unloaded bananas at Hamburg in 1912 and therefore of tropical origin; *A. niveus* (closely related to the foregoing); *A. conicus*, isolated from the soil by Hanzava in Japan (1911) and Miss Dale in England (1914); and *A. pseudoglaucus*, found by Hanzava at Sapporo, Japan, on koji [ibid., iv, p. 305] in 1911. Emended diagnoses are also given of a number of other species, and in this connexion some general principles of taxonomy are outlined. A key is given for the determination of species of *Aspergillus* by their morphological and physiological characters, and a list of synonyms is appended.

ULLSCHECK (F.). **Penicillium-'Arten' und -'Rassen' im Käsekeller.** [*Penicillium* species and strains in the cheese cellar.]—*Bot. Arch.*, xxiii, 3–4, pp. 289–384, 41 figs., 1929. [English abstract.]

After a full description of the morphological, cultural, and biological characters of 15 green *Penicillium* forms isolated from cheese, wood, walls, and other objects in a number of dairies in the Kiel district, and studied by special methods [which are described

in detail], the author discusses the problem of the systematic value of the forms observed.

Referring to Biourge's treatment of the genus [*R.A.M.*, iii, p. 178], he points out that, although *Penicillium* is designed as a 'group' in the title, it is treated as a genus in the body of the work, but the subdivisions of the genus in Biourge's system are not easily utilized in practice, especially those based on the characters of the vegetation ('rasen'). The 15 forms isolated by the author fell into nine macroscopically and microscopically distinguishable groups, of which, however, only groups iv (probably *P. biforme*), vii (*P. roqueforti*) [ibid., iv, p. 109], and viii (*P. spinulosum*) could be identified from the literature. Group ix was a *Stysanus* form, which is possibly not closely related to the others. All the forms except *P. spinulosum* (a representative of the *Aspergilloideae*) belong to Biourge's subgenus *Eu-Penicillium*, and they appeared to represent five different subsections of his section *Bulliardium*. According to Janke's system of classification ('Allg. Techn. Mikrobiologie. I. Die Mikroorganismen', 1925), all the fungi under consideration, except *P. spinulosum* and *Stysanus*, are members of the section *Penicillium* s. str. and fall into the collective species *P. glaucum* and *P. candidum*. Nevertheless they appear to constitute a continuous series of forms and in the author's opinion are best regarded as a number of strains of a single collective group.

A bibliography of 37 titles is appended.

GUYOT (A. L.). **Note sur deux Urédinées intéressantes de la flore cryptogamique picarde.** [Note on two interesting Uredinaceae of the Picardy crytogamic flora.]—Reprinted from *Bull. Soc. Linn. Nord de la France, 1928*, 417, 20 pp., 3 figs., 1929.

The author gives historical and morphological notes on two interesting rusts observed by him in Picardy. *Puccinia rübsaameni* causes a witches' broom type of deformation on one-year-old shoots of marjoram (*Origanum vulgare*), characterized by a reduction in the size of the leaves and length of the internodes, as well as by profuse branching below the terminal inflorescence. This species closely resembles *P. caulincola*, which causes a marked deformation of thyme (*Thymus serpyllum* and *T. chamaedrys*) stalks, but the teleutospores of the latter are smaller (26·6 by 16·7 compared with 30·7 by 19·7 μ in the marjoram rust), so that the two organisms may be regarded as distinct.

Gentiana germanica was found to be heavily infected by *P. gentianae*, hitherto reported (in France) only from the peaty meadows of the Côte d'Or.

A table is given showing the hosts and distribution of the Uredinaceae parasitizing Labiatae in Europe.

CIFERRI (R.) & REDAELLI (P.). **Studies on the Torulopsidaceae. A trial general systematic classification of the asporigenous ferments.**—*Ann. Mycol.*, xxvii, 3–4, pp. 243–295, 1929.

In extension of their studies on the Torulopsidaceae with red pigment [*R.A.M.*, v, p. 229], the authors give an account of the other non-sporing, yeast-like fungi that do not produce conidia

borne on mycelial conidiophores, all of which are grouped in the family Torulopsidaceae of the Mucedineae amerosporae, alongside the Oosporaceae, if not actually to be included in this family. Evidence of affinity to the true yeasts (Saccharomycetaceae) is not considered by the authors to be at all convincing. The Torulopsidaceae as thus defined are divided into two sub-families, Torulopsideae [to replace the authors' previous sub-family Cryptococcaceae: loc. cit.] and Mycotoruleae, and include the following genera, a key to which is given: *Asporomyces*, *Kloeckeria* (syn. *Pseudosaccharomyces*), *Pityrosporum*, *Eutorulopsis* (*Cryptococcus* p.p.), *Torulopsis* (*Cryptococcus* p.p.), *Blastodendrion* (*Monilia* p.p. and *Cryptococcus* p.p.), *Geotrichum* (*Oospora* p.p. and *Mycoderma*), *Pseudomycoderma*, *Pseudomonilia* (*Monilia* p.p.), *Candida* (*Monilia* as generally understood by medical writers), *Mycotorula*, and *Enantiothamnus*. *Oidium* is reserved for the conidial stages of the Erysiphaceae, and *Candida* for fungi congeneric with *Monilia candida* Bon. in agreement with Berkhout [ibid., iii, p. 556]. *Cryptococcus* is abandoned, as it is impossible to determine which of a group of species it should be used to define.

GADD (C. H.). **The relationship between food reserves of the Tea bush and disease.**—*Tea Quarterly*, ii, 2, pp. 54–64, 1929.

The writer recapitulates his views on the etiology of the *Diplodia* disease of tea [*Botryodiplodia theobromae*] in Ceylon [*R.A.M.*, viii, p. 202]. The only form of the disease discussed here is that associated with frequent pruning at times when the reserve food supplies, stored in the root system of the bushes, are depleted. An examination of the roots of bushes failing to make new growth within the normal time after pruning showed a uniform absence of starch, even where no fungus was present. The factors leading to the depletion of food reserves in the tea bush are complex and require further investigation, but the obvious immediate solutions of the problem are rest and light pruning.

DUFRÉNOY (J.), STAMATINIS (N.), & SAREJANNI (J.). **Études cytologiques sur la mosaïque du Tabac.** [Cytological studies of Tobacco mosaic.]—*Rev. Path. Vég. et Ent. Agric.*, xvi, 3, pp. 106–117, 10 figs., 1929.

Cytological studies of tobacco plants artificially inoculated with mosaic [cf. *R.A.M.*, viii, pp. 188, 407, 518] showed that in the affected cells the chloroplasts usually undergo a process of fatty degeneration, while their stroma shrinks to a cortical pellicle, a lateral band, or even a few points. The light green spots which appear on the leaves result from the destruction of the chlorophyll of the plastids in certain cells, the disease impeding the photosynthetic formation of starch; they may contain necrosed cells in which the coagulated cytoplasm appears as a spongy, contracted mass.

In the dark areas of affected leaves the cells at first appear to show an excess of metabolic activity; the mitochondria (which in healthy cells are filamentous) are arranged in chains, subsequently breaking up into short rods or granules. As the disease progresses the protein crystals in the cells increase in numbers and size;

further, the lipo-proteid complex becomes dissociated and the plastids liberate lipides and proteids.

The first symptom of tobacco mosaic revealed by cytological examination is the localized development of small, filamentous vacuoles, surrounded by a cytoplasm rich in lipides and soluble nitrogenous compounds, resulting in the appearance known as the 'apparatus of Golgi' [loc. cit.]. The cytoplasm in the neighbourhood of these filamentous vacuoles takes certain stains more readily than that of the rest of the cell.

In the cytoplasm of affected cells a highly refractive inclusion or 'vacuolated body' is readily visible without staining; in vital staining with Nile blue this inclusion is coloured blue, while osmic acid stains it brown, indicating an abundance of lipides. Affected cells may also form striate bodies which react like albuminoids and stain with Milon Denigès reagent, erythrosin, and syrupy phosphoric acid.

DUFRÉNOY (J.). **Étude cytologique des taches blanches du Tabac.** [Cytological study of the white spots in Tobacco.]—*Rev. Path. Vég. et Ent. Agric.*, xvi, 4–5, pp. 146–149, 3 figs., 1929.

A cytological study of the sharply defined white spots, termed by Delacroix (*Ann. Inst. Agron.*, v, p. 58, 1906) 'la maladie des taches blanches', that sometimes occur on tobacco leaves (especially on those that exhibit the usual symptoms of mosaic) and that have been attributed in Sorauer's 'Handb. der Pflanzenkrankh.', 4th ed., I, p. 922, 1921, to a virus disease, showed that the cells within the spots are contracted and filled with amyloplasts, each containing several large starch grains. Bordering the spots may be seen some still living cells containing, besides amyloplasts rich in starch, a few stainable mitochondria ranged along the strands of cytoplasm that surround filamentous vacuoles ('Golgi's apparatus'). In some cases the amyloplasts lose a part of the starch, which is then concentrated at one of their ends, the other one being empty, but as a general rule the dead cells contain amyloplasts well filled with starch.

The author's work, as well as that of some other cytologists, indicates that the vacuoles tend to take a filamentous shape in cells in which appreciable amounts of soluble nitrogenous substances are formed by proteolysis. These observations would therefore show that the cells in the tobacco white spots are the seat of an active proteolytic process, while carbohydrates accumulate in them in the form of starch.

ARTHUR (J. M.) & NEWELL (J. M.). **The killing of plant tissue and the inactivation of Tobacco mosaic virus by ultra-violet radiation.**—*Amer. Journ. of Botany*, xvi, 5, pp. 338–353, 3 pl., 1 diag., 1 graph, 1929.

A series of experiments was conducted to determine, firstly, the length of exposure necessary to kill the virus of tobacco mosaic, when purified and subjected to ultra-violet radiation from an unprotected quartz tube mercury vapour arc radiator, in a water solution in thin layers between quartz and glass plates; and secondly, whether the virus could be killed by these rays within the plant tissue. The potency of the virus was tested by Holmes's

method [*R.A.M.*, viii, p. 532]: the leaves of *Nicotiana glutinosa* are lightly rubbed with a piece of cheesecloth moistened with the virus solution, the potency of which is indicated by the number of colonies of dead cells or circular brown lesions developing on the leaves after two or three days' incubation. Irradiation was effected by distributing six drops of the purified virus over an area 2 to 3 inches square on a glass plate, covered with a quartz plate $\frac{1}{8}$ of an inch thick, through which the virus was exposed at about 15 inches from the radiator. The quartz plate was then removed and 15 to 20 drops of distilled water added in order to saturate a small piece of cheesecloth, with which the irradiated virus was lightly rubbed over the tobacco leaves. The first experiment showed that the virus could be completely inactivated by exposures of one minute, whereas controls protected by window glass or a Noviol *O* filter (wave-lengths 312 and 390 $\mu\mu$, respectively) produced large numbers of lesions after 10 minutes' exposure to mercury arc radiations. In subsequent tests it was found that most of the virus was inactivated after 5 seconds, while not a single lesion was produced after exposures of 15, 25, and 45 seconds.

Further experiments showed that the virus spread on the leaf surface could be killed by one minute's immediate exposure to irradiation.

There was no appreciable loss of virulence, however, from irradiation the day after inoculation, the virus apparently resisting inactivation once it had penetrated a sufficient depth into the plant tissue.

YOUNG (P. A.). **Tobacco witches' broom. A preliminary report.** —*Amer. Journ. of Botany*, xvi, 5, pp. 277–279, 1 pl., 1929.

A White Flowering tobacco plant, inarch-grafted on an Earliana tomato stem affected by witches' broom [*R.A.M.*, viii, p. 122], developed several small, spindly branches at the base of the stem after about two months. Numerous slender axillary branches, bearing much dwarfed leaves, were also found. The new leaves on the main stem were abnormally small and many of them showed marginal or complete flavescence (defined as a non-necrotic, juvenile condition of abnormally pale green, hyaline, or yellow coloration). The affected plant bloomed profusely, but the flowers were only half as long and broad as the normal ones of this variety. Later, rosettes of small leaves, 1 to 2 cm. long, appeared on the stems: many of these leaves turned white, but with green veins and necrotic brown spots.

Two cuttings from the diseased plant showed no symptoms of witches' broom for about three months, after which each produced some 20 spindling stems 1 to 100 cm. in length, which exhibited all the symptoms of the parent plant. Fifty other cuttings died.

Two Earliana tomato plants grafted on the diseased tobacco plants developed the typical symptoms of tomato witches' broom within 90 days.

A histological examination of sections of normal and diseased tobacco leaves showed that in the latter the marginal palisade cells were abnormally broad, only 17 to 35 μ in length compared with

25 to 50 μ in the healthy material, and with prominent intercellular spaces. Some of the flavescent margins had no normal palisade cells, were very thin, had few chloroplasts, and an excessive development of intercellular spaces. Similar conditions were found in tomato leaves with marginal flavescence due to witches' broom.

HOPKINS (J. C. F.). **Blackfire of Tobacco.**—*Rhodesia Agric. Journ.*, xxvi, 4, pp. 371–373, 1929.

A description is given in popular terms of the symptoms of blackfire of heavy leaf tobacco as found in Southern Rhodesia when late rains occur. The condition can be distinguished from the true angular leaf spot caused by *Bacterium angulatum* by the abundant development on the leaves of numerous circular, dark brown spots about one-eighth to one-quarter inch in diameter and characterized by the formation of concentric rings around their margins. Later these spots may coalesce into large dark brown blotches of an angular shape. Sometimes an almost black lesion, up to two inches long, may be seen on the midrib, and numerous small angular spots on the small veins at the tip of the leaf. Ultimately the whole leaf gradually turns yellow and then brown, droops, and dies. *Bact. angulatum* has not been found in these spots and, in the author's opinion, it is safe to assume that the Rhodesian form of the disease is identical with that described by Valleau in North America as due to physiological causes [*R.A.M.*, viii, p. 408]. The trouble may possibly be alleviated by smaller dressings of nitrogenous fertilizers applied as soon as the plants begin to turn yellow, followed, if necessary, by a further small dressing given at a time suitable to maintain growth. In Rhodesia, as in America, a relationship has been noted between applications of stable manure and control.

BÖNING (K.). **Die Brennfleckenkrankheit des Tabaks.** [Tobacco anthracnose.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz*, vii, 2, pp. 36–40, 1929.

Popular notes are given on the stem and rib scorch disease of *Nicotiana rustica* in Bavaria [*R.A.M.*, vii, pp. 547, 548], which has now been found to be due to a species of *Colletotrichum*, possibly distinct from *C. nicotianae* Averna-Sacca, reported as the causal organism of an anthracnose of tobacco in Brazil [ibid., iii, p. 179]. The conidia of the Bavarian fungus measure 15 to 22 by 4 to 5 μ, with setae 60 to 90 μ in length. On the leaves the disease causes the development of round or irregular brown spots, becoming almost white on the young leaves, and up to a centimetre in diameter. On the older leaves the spots are surrounded by a dark brown ring, outside which may be a water soaked area. The flowers, seed-capsules, and seeds may be attacked in addition to the veins, petioles, and stems, on which elongated lesions appear; seed infection is presumably the cause of the occurrence of the disease in the seed-bed. According to the intensity of infection individual plants may be little damaged or may be killed; epidemic outbreaks have also been observed. As the affected tissues dry up they crack

and the leaf spots may become perforated. The most serious form of the disease is that affecting the water-conducting tissues of the stems and petioles, as this leads to complete withering of the whole or part of the plant. The affected cells become choked with a gummy substance which destroys or masks the hyphae. Infection has further been observed on seedlings in East Prussia grown from Bavarian seed. The red-flowering tobacco [*N. tabacum*] may also be infected. Spraying the seedlings with 1 per cent. Bordeaux mixture is recommended as a supplement to cultural measures for the control of the disease.

LIU (H.). **The salt requirements of Tobacco grown in sand cultures.**—*Maryland Agric. Exper. Stat. Bull.* 288, pp. 133–154, 5 figs., 2 diags., 1 graph, 1926. [Received July, 1929.]

A condition similar to 'sand drown' was observed in each of six tobacco plants grown in sand cultures containing an extremely low proportion of magnesium sulphate [*R.A.M.*, viii, p. 473]. The first symptom was the development of a black spot at the point where the young leaf emerges from the bud. This spot spread along the veins until the whole leaf was darkened and presented a desiccated appearance. The higher the calcium nitrate content of the cultures, the earlier did these symptoms appear. Histological studies of the injured tissues revealed various disturbances characteristic of an excessive nitrogen supply.

RAMSEY (G. B.) & BAILEY (ALICE A.). **The development of soil rot of Tomatoes during transit and marketing.**—*Phytopath.*, xix, 4, pp. 383–390, 2 graphs, 1929.

Soil rot of tomatoes (*Rhizoctonia* [*Corticium*] *solani*) [*R.A.M.*, vii, p. 125] is stated to cause heavy losses among southern-grown tomatoes in the United States, e. g., from Florida, Texas, and Mississippi, during their transit to the northern markets, as well as in the field and in packing-houses. The amount of injury is directly related to weather conditions, infection being favoured by heavy rains or successive moderate rains that keep the surface soil wet. Experimental consignments of 522 southern tomatoes (168 diseased and the rest healthy) made during 1926–7 and 1927–8 and submitted to detailed examination, averaged 9·8 per cent. new lesions on arrival at Chicago. About 50 per cent. of these lesions developed in both green and ripe fruits that showed no ruptures in the epidermis; in the remaining cases the organism entered through wounds and stem and blossom scars. The new lesions averaged 11·6 mm. in diameter after five days in transit, the maximum rate of development occurring in those approximately 15 mm. in diameter at the time of dispatch. The older spots up to 5 mm. in diameter, constituting the bulk of those overlooked in commercial grading and packing, attained an average diameter of 17·2 mm. in five days' transit. A consignment of inoculated tomatoes developed 100 per cent. infection. The lesions produced in this case measured about 20·4 mm. in diameter and ranged from 5 to 20 mm. deep after five days in transit.

Eighteenth Annual Report of the New York State Conservation Department for the year 1928.—424 pp., 169 figs., 7 diags., 7 maps, 1929.

This report contains the following references of phytopathological interest. The number of co-operators enlisted in blister rust [*Cronartium ribicola*] control work in New York State and the area under white pine [*Pinus strobus*] protected [*R.A.M.*, viii, p. 538] during 1928 are estimated to have increased by 50 per cent. The work of protection necessitated the eradication of 1,964,604 currant and gooseberry bushes. The number of *Ribes* bushes found per acre varied from 1 to 977, and averaged 204, the areas selected for the operations being those in which initial eradication took place in 1920–21. A new plot, half an acre in extent, for the study of the damage caused to white pines by blister rust was established near Keeseville, New York. Of the 1,116 trees on this plot, 593 are severely stunted; most of these have already been killed, the mortality due to blister rust alone being estimated at 42 per cent. of the stand. In the summer of 1928, 387 out of 950 trees in another observation plot established near Clintonville in 1925 were found to have died from rust infection, and a further 134 are doomed from the same cause. The total damage inflicted by the fungus in this plot may be estimated at 56 per cent. Six years' observations have shown that some 75 per cent. of all the white pines attacked by blister rust belong to the thrifty, vigorous class. It is estimated that the remaining trees on the Clintonville plot will yield about 10,000 board feet of very inferior timber, as compared with a normal production of 35,000 board feet of good quality wood.

In June, 1928, more than twenty species and varieties of hard pines were inoculated with the Woodgate rust [*Peridermium* sp.: ibid., viii, p. 272 and next abstracts] from Scotch pine (*Pinus sylvestris*) with positive results. Some of the species tested, however, were so resistant that the infection spots failed to develop to any extent.

Two severe outbreaks of the shoe string fungus (*Armillaria mellea*) occurred in Clinton County during 1925 in a natural stand of 22-year-old white pines [ibid., vii, p. 685], which was first observed to be infected in the previous summer. The stand in the infected part was estimated at 9,400 trees per acre, of which 5,400 (57 per cent.) were living. In order to prevent the spread of the fungus, trenches 2 ft. deep by 10 inches wide were dug round the affected area, all the trees inside which were felled and the stumps removed. This measure appears to have been entirely successful, for though rhizomorphs were found in 1926 outside the trenched area, the clearing of the latter seemed to have dried out the ground and the rhizomorphs were unable to attack the trees in the vicinity.

The report contains a number of other items of silvicultural and general interest.

York (H. H.). **The Woodgate rust.**—*Journ. Econ. Entom.*, xxii, 3, pp. 482–484, 1929.

Attention is drawn to the striking similarity between the

symptoms of the Woodgate rust [*Peridermium* sp.; see preceding abstract] on two- and three-needle pines and those caused by the indigenous *Cronartium cerebrum* [*R.A.M.*, viii, p. 77] on *Pinus banksiana*, *P. rigida*, and other pines in north-eastern North America. The life-histories of these two fungi, however, are entirely different, the Woodgate rust being autoecious, producing only aecidiospores which serve to spread the fungus directly from pine to pine, while *C. cerebrum* is heteroecious, with the uredo-teluto stage on oaks.

The galls of the Woodgate rust may be distinguished from those of *C. cerebrum* by their oblate shape and well-defined rims or collars of bark at the margins. The galls of *C. cerebrum* are usually longer than they are broad and have no well-defined rims at the margins. The aecidia of the Woodgate rust are irregular and confluent, while those of *C. cerebrum* are somewhat cerebroid.

At Woodgate, New York, the aecidiospores of the new *Peridermium* are produced chiefly during June. They infect the pines directly through the epidermis of the current season's stem growths. About a year after infection, swelling of the twig at the point of infection first become noticeable, and two years later the galls produce aecidiospores. Annual crops of spores may be borne until the galls are at least six years old, after which this process is intermittent. Galls 20 to 23 years old have been observed to develop aecidia in three successive seasons.

The Woodgate rust affects trees of all ages, seedlings usually being killed within a few years. Young trees may survive for twenty years or more, but they generally show severe malformation and cannot be used for timber. More than 18,000 galls were counted on a single tree.

The source of the Woodgate rust is unknown. The extensive *Pinus sylvestris* plantations at Woodgate were established between 1870 and 1884 with seed from Bavaria. Gall rusts are not known to occur in Europe, and it is therefore evident that the fungus must have been introduced either from the Pacific States or from Asia. Since 1920 the disease, which before that time had spread slowly, has made very rapid progress. The great activity of the fungus, its destructive character on young trees, and its ready capacity for infection at relatively high temperatures (shown by inoculation experiments) indicate that it may become a serious menace in the South Atlantic States, where there are immense areas of young reproduction of susceptible pines.

Investigations have shown that the western yellow pine (*P. ponderosa*), Japanese black pine (*P. thunbergii*), Corsican pine (*P. nigra* var. *poirettiana*), Jersey pine (*P. virginiana*), lobbolly pine (*P. taeda*), and others are susceptible to the Woodgate rust.

McCallum (A. W.). **Woodgate rust in Canada.**—Abs. in *Phytopath.*, xix, 4, p. 414, 1929.

The gall-forming rust on Scotch pine [*Pinus sylvestris*] reported from New York in 1925 under the name of Woodgate rust [*Peridermium* sp.] has been found to occur in Canada. It was first collected in 1918, but was then believed to be identical with *Cro-*

nartium cerebrum [see preceding abstract]. Diseased trees have been observed in various localities of Ottawa, Ontario, and Quebec, and specimens have also been received from Nova Scotia. Except at Ottawa, where some of the galls are about 40 years old, no galls above seven years old were found.

MEINECKE (E. P.). **Experiments with repeating Pine rusts.**—*Phytopath.*, xix, 4, pp. 327–342, 3 figs., 1 graph, 1929.

As a result of observations and experiments made since the publication of his former papers on repeating pine rusts, i. e., those transmissible from pine to pine in the aecidial stage (*Phytopath.*, vi, p. 225, 1916; x, p. 279, 1920), the author now believes the gall-forming *Peridermium* common on *Pinus radiata* and other coastal pine species of California to be not *P. cerebrum* [see preceding abstracts] but a form of unknown relationship, provisionally termed *P. cerebroides*. The gall-forming *Peridermium* occurring on *Pinus contorta*, *P. sabiniana*, *P. ponderosa*, and other pines of the interior mountain ranges is maintained as the aecidial form of *Cronartium harknessii* nov. comb., its identity being confirmed by the successful inoculation of *Castilleia* (? *miniata*), the alternate host, with aecidiospores from typical galls on *P. contorta* and *P. sabiniana*. The same aecidial material also produced infection on different species of pines inoculated (*a*) through tangential slits in the epidermis and cortical layers of the main stem, or (*b*) by means of spore-showers, the spores being either dusted over plants previously sprayed, or suspended in water and sprayed on to the pines. The former method gave 70 per cent. of successful infections and the latter 78·5 per cent. Forty-four per cent. of the pines inoculated by spore-showers in the nursery contracted infection. *P. coulteri* has been added to the list of hosts susceptible to *C. harknessii*. Aecidiospores of *P.* (?) *cerebroides* also were found to be capable of infecting *Pinus radiata* by the spore-shower method.

The incubation period for *C. harknessii* was shown to range from 3 to 14 months with the slit method and from 5 to 27 months using the spore-shower. The first galls on *P. radiata* inoculated with *P.* (?) *cerebroides* developed in six months and the last after twenty months. The galls formed by *C. harknessii* varied considerably in their rate of growth, the highest of the averaged measurements of the galls in three series of inoculations being 6·4 by 5·7 cm. in 54 months while the most rapid development was 18·4 by 1·4 cm. in 28 months. After 25·6 months the galls produced by *P.* (?) *cerebroides* in a small series measured on an average 3·2 by 2 cm. Both fungi produced more or less spherical to piriform galls. *C. harknessii* produced spores 24 to 37 months after inoculation in these experiments.

The formation of witches' brooms and marked stunting are characteristic effects of attack by both *C. harknesii* and *P.* (?) *cerebroides*, while death may result from infection, especially among trees grown in the greenhouse. Infection probably occurs through short shoots or buds of spurs poorly protected by bud-scales, not through the needles. Pycnidia were not found either in natural or artificial galls. The branching of the germ-tubes produced by

the aecidiospores may possibly represent an approach to a promycelium, but no sporidia were observed. The mycelium is uninucleate and the spores binucleate, so that they would appear to be true aecidiospores.

LACHMUND (H. G.). **Cronartium comptoniae Arth. in western North America.**—*Phytopath.*, xix, 5, pp. 453–466, 1 map, 1929.

Lodge-pole pines (*Pinus contorta*) (mostly 5 to 10 years old) in the Pacific Northwest (west of the Cascade Mountains from Ilwaco, Washington to Prince Rupert, British Columbia) have been found to be attacked by the rust *Cronartium comptoniae* (*Bull. Torrey Bot. Club*, xxxiii, p. 27, 1906). The only known host of the uredo-teleuto stage of the fungus is the sweet gale (*Myrica gale*), while the aecidial stage has been found exclusively on *P. contorta*. The disease is indigenous in the west, as in the east, but has hitherto been overlooked owing to the scantiness and inaccessibility of the alternate host, combined with the resemblance of the aecidial stage to the more widely distributed *C. filamentosum*. The disease has been found very prevalent on *M. gale* in the autumn irrespective of the proximity of the aecidial host, infection in these cases presumably being due to long-distance dissemination of the rust by wind-borne aecidiospores. Both the aecidial host and *M. gale* occur transcontinentally between the northern limits of the known ranges of the rust in the east and west. It is probable, therefore, that the disease is also transcontinental with a connexion between the eastern and western ranges.

Young lodge-pole pines in the vicinity of infected *M. gale* plants are exceedingly likely to be attacked by *C. comptoniae*, which appears to infect only the nodes and internodes originating during the first four years of life. In such situations 10 per cent. or more of the seedlings may be killed, but once the susceptible period is past, recovery is frequent. *P. ponderosa*, which is very liable to infection by *C. comptoniae* in eastern nurseries, appears to be immune in the west.

MANSHARD (E.). **Lässt sich die Kupferkalkbrühe bei der Schüttebekämpfung ersetzen?** [Can Bordeaux mixture be replaced in the control of leaf fall?]—*Forstarch.*, *1929*, 8, pp. 160–162, 1929.

Three commercial preparations intended for the control of leaf fall of pines [*Lophodermium pinastri*: *R.A.M.*, viii, p. 2] were used in a comparative test with home-made Bordeaux mixture. The numbers of healthy trees in the various plots were as follows: Bordeaux mixture 768 out of 1,200, two commercial salts 389 and 299, respectively, a liquid colloidal copper preparation 302, and untreated 265. It is evident that Bordeaux mixture is superior to any of the other substances tested. Of the two salts, that forming a finely flocculent, slowly settling suspension was more effective than that producing a coarse, rapidly settling one.

HØDAL (A.). **Om sykdommer pa den franske Bergfuru.** [On the diseases of the French mountain Pine.]—Supplement to *Tidsskr. for Skogbruk, 1929*, 4, pp. 36–49, 5 figs., 1929.

The writer's observations, together with those of Jørstad [details of which are given], indicate that the leaf fall of French mountain pines (*Pinus montana* var. *gallica* or var. *arborea*) in Norway and Denmark, attributed to *Lophodermium pinastri* [see preceding abstract], is almost exclusively due to the causal organism of die-back [*Brunchorstia pinea*: see next abstracts].

JØRSTAD (I.). **Furuens knopp- og grentørke.** [The die-back of Pine shoots and branches.]—Supplement to *Tidsskr. for Skogbruk, 1929*, 4, pp. 1–35, 4 figs., 1929.

A detailed account is given of the history, symptoms, and distribution, in various European countries and the United States, of the die-back of Scotch pine (*Pinus sylvestris*), *P. laricio* [var.] *austriaca*, *P. montana*, *P. montana* [var.] *uncinata*, *P. murrayana*, and *P. cembra* caused by *Brunchorstia pinea* [*R.A.M.*, vii, pp. 209, 553]. In Norway, Denmark, and the south of Sweden the cultivation of *P. laricio* [var.] *austriaca* has been practically abandoned on account of the ravages of this fungus. *P. montana* seems to be fairly resistant to the attacks of *B. pinea* in Norway and Denmark, while *P. montana* [var.] *uncinata* is susceptible. *P. sylvestris* appears to become more susceptible with age, infection occurring chiefly on trees over twenty years old.

Discussing the synonymy of the causal organism [which is fully described], the author finds no evidence of any connexion between *B. pinea* and its alleged conidial stage *Cenangium abietis*, which occurs as a saprophyte or weak parasite on *P. montana* [var.] *uncinata*, *P. murrayana*, *P. gerardiana*, *P. strobus*, and *P. cembra* throughout Norway, frequently in association with the closely related *Crumenula pinicola* and with *Cronartium pini* [ibid., vi, pp. 201, 202].

In order to limit the damage caused by *B. pinea* in the coastal districts of Norway, the writer suggests the discontinuance of pure stands of such highly susceptible varieties as *P. laricio* [var.] *austriaca*, *P. montana* [var.] *uncinata*, and *P. cembra*, which should be cultivated, if at all, in mixed plantations with resistant conifers, e.g., spruce [*Picea*]. As the fungus has been shown to infect quite young seedlings (down to one year old), it is essential to remove all diseased individuals of susceptible varieties from the vicinity of nurseries. Spraying with Bordeaux mixture might be tested as a preventive measure in particularly valuable stands.

JØRSTAD (I.). **Soppsygdommer på fransk Bergfuru i Norge.** [Fungous diseases of French mountain Pine in Norway.]—Supplement to *Tidsskr. for Skogbruk, 1929*, 4, pp. 50–51, 1929.

In addition to *Brunchorstia pinea*, which is stated to be the only fungus of any importance on the French mountain pine [*Pinus montana* var. *gallica* or var. *arborea*: see preceding abstracts], the following organisms have also been observed: *Crumenula pinicola* and *Cenangium abietis*, both weak parasites;

the pine canker fungus (*Dasyscypha subtilissima*) [*R.A.M.*, vi, p. 201]; *Lophodermium pinastri*, which was particularly severe on two-year-old trees in 1927; *Hypodermella sulcigena*, with its conidial stage, *Hendersonia acicola*; *Cronartium pini*; *Thelephora terrestris*, which is thought to have been partially responsible for winter injury to older trees in 1926 and 1927; and *Armillaria mellea*, found at the base of a dead mountain pine.

WOODWARD (R. C.), WALDIE (J. S. L.), & STEVEN (H. N.). **Oak mildew and its control in forest nurseries.**—*Forestry*, iii, 1, pp. 38–56, 2 pl., 1929.

In giving a brief outline of the history, geographical distribution in Europe, and taxonomy of the oak mildew (*Microsphaera quercina*) [*R.A.M.*, viii, p. 411], the authors state that, since its first record in England in 1908, the fungus has rapidly spread over the whole of Great Britain, wherever oaks (especially *Quercus pedunculata* and *Q. sessiflora*) are grown, and that it also may occur on beeches. Although the severest damage is done to young oak seedlings and oak coppice, the disease may attack trees of all ages, being particularly dangerous to oaks that have been defoliated by caterpillars, as the second set of leaves is very susceptible. Repeated caterpillar attacks followed by mildew are known to have brought about the death of many trees in a few years, while there is no record of any oaks having been killed by the caterpillars alone before the appearance of the mildew.

Both the foliage and the young stems, before their tissues are toughened, are susceptible. Axillary buds, the scales of which are still soft and loosely applied, may also be infected. The mycelium remains dormant in these infected buds throughout the winter, and resumes active growth in the following spring, when conidia arise on the young shoots from the buds and start secondary infections. As far as observed, this is the sole mode of overwintering of the oak mildew in Great Britain, since its perithecia have not been found in this country and inoculations with ascospores from perithecia received from Italy gave negative results. Experiments also failed to confirm the presence in England of the chlamydospores of the fungus which, according to Petri [ibid., iv, p. 381], play a prominent part in causing spring infections in Italy. It is pointed out, however, that bud infection is much less frequent in the oak than in apple mildew (*Podosphaera leucotricha*) [ibid., vi, p. 733]. Counts made in the spring of 1928 on oak transplants that were severely mildewed in 1927 showed that not more than 7·6 per cent. of the trees bore primary infections, compared with 50 per cent. reported in the apple mildew. This difference is believed to be due to the fact that the bud-scales of oak harden more rapidly than those of the apple, and that the oak mildew does not become widespread until later in the summer, when the buds are no longer susceptible to infection. In 1928, the first primary infections were observed at Oxford on 7th May, and the first secondary infections on 14th June, active spread being still later.

Experiments carried out in 1927 and 1928 in several forest nurseries showed that oak mildew may be successfully controlled by spraying the seedlings with colloidal sulphur (ialine or cosan)

or with flowers of sulphur made up as a paste, at the rate of 2 to 4 lb. per 100 gallons water, with the addition of a calcium caseinate spreader. Under average conditions, three to five applications are necessary, the first being made as soon as the mildew appears. In the experiments described this treatment protected over 50 per cent. of the plants from all infection; the growth of the seedlings was increased as also their dry weight, and the proportion of plants with good leaders was also augmented. Spraying with 1 per cent. sodium chloride or lime-sulphur burned the young foliage; dusting with flowers of sulphur was not efficacious, and ammonium polysulphide sprays were only partially so.

[An abridged and popular version of this paper, by Woodward, is given in *Gard. Chron.*, lxxxvi, p. 52, 1 fig., 1929.]

BERTUS (L. S.). **A seedling disease of Dadap (Erythrina lithosperma Bl.).**—*Trop. Agriculturist*, lxxii, 5, pp. 276–278, 1 pl., 1929.

On the dead portions of the stems of dadap seedlings (*Erythrina lithosperma*) affected by a disease which caused the stems to shrivel up and become straw-coloured at ground level, this part being bordered above and below by a narrow, purple-brown margin, the author found a species of *Fusarium* and a *Phoma*. Inoculation experiments [details of which are given] showed that whereas the *Phoma* was only a secondary parasite, the *Fusarium* could attack wounded or unwounded stems, young and fully grown leaves, and young shoots which were killed back, though very moist atmospheric conditions were necessary for it to become destructive.

On maize-meal agar the *Fusarium* developed a rich growth of white, cottony, septate, branched hyphae, 2 to 6 μ in diameter, and pale coral-red spores were produced from ochraceous-brown sporodochia in a few days. The hyaline, elliptical, fusoid or cylindrical-ovoid microconidia measured 6 to 12 by 2 to 3 μ; the macroconidia were hyaline, straight or slightly curved, with falcate tips, were divided by one to four, usually three, transverse septa, and measured 15 to 40 by 2·5 to 4 μ. The author considers that this *Fusarium* is probably a different species from that previously reported by Park on the same host [*R.A.M.*, v, p. 522; vii, p. 68].

VAHID (S. A.). **Damage to Acacia arabica by Fomes pappianus Bres.**—*Indian Forester*, liv, 12, pp. 662–664, 2 pl., 1928.

Fomes pappianus was first observed on *Acacia arabica* in India in 1902. The fungus attacks the heartwood of this tree in Berar, producing a reddish-purple discoloration followed by the development of black dots and white patches, the latter eventually becoming holes. The diseased wood is extremely brittle, the branches and even the trunk being liable to snap off in the middle. In some cases the roots are rotted, so that the trees, having no hold in the soil, are readily blown down. Of the three varieties of *A. arabica*, the Telia has been found to be more susceptible to *F. pappianus* than Kauria or Ramkanthi, but the latter suffer the most severe damage when attacked.

Little is known about the mode of infection of *F. pappianus*. Propagation through the soil is suggested by the fact that plough-

ing a diseased area reduces the incidence of infection. The destruction of the sporophores also considerably reduces infection, indicating that spores play a part in the spread of the disease. The fungus does not attack young, healthy trees, its attacks being mostly confined to areas in the wood previously infected by the insect *Coelosterna glabrata*.

Some degree of control has been achieved by drastic thinning and the cultivation of the soil for three years prior to sowing *A. arabica*, which should also be grown in a mixed stand with other suitable trees.

BRAUN (K.). **Bericht über das Auftreten von Schädlingen und Krankheiten im Obst- und Gemüsebau im Regierungsbezirk Stade während der Monate September, Oktober, November, Dezember, 1928, nebst Nachträgen für das ganze Jahr.** [Report on the occurrence of fruit and vegetable pests and diseases in the administrative district of Stade during the months of September, October, November, and December, 1928, with supplements for the entire year.]—Reprinted from *Die Landwirtschaft,* 20, 21, 22 (*Wochenbeil. zum Stader Tagebl.*), 1 pl., 1929.

Heather (*Calluna vulgaris*) was affected in 1927 and 1928, in a number of districts [which are enumerated] of North Germany, by the noticeable appearance in large patches of a disease associated with a brown discoloration and a desiccated, burnt appearance of the plants. In addition to insects, the mycelium of a fungus, possibly *Stemphylium ericoctonum* (hitherto only observed on *Calluna* in the greenhouse), was found on some of the diseased roots. Further investigations are necessary to ascertain whether this organism is responsible for the above-mentioned symptoms.

PEARSON (R. S.). **Mycology.**—*Rept. Forest Products Res. Board for the period ended 30th September, 1928,* pp. 51–54, 1929.

In this report, the first issued by the newly established Forest Products Research Laboratory at Princes Risborough, Buckinghamshire, an account is given of researches conducted and projected on timber preservation and the decay of wood caused by fungi. The investigations concerned fall into two groups, one consisting of the systematic observation of the various kinds of timber rot and of the fungi responsible, and the other of a study of the physiology of these fungi, undertaken to determine the exact conditions in which attack can occur, and how to prevent it. One of the first tasks was to build up a series of type cultures derived from sporophores named by competent systematists. Most of the fungi which commonly cause decay of wood in England have been collected and cultured, while further cultures have been obtained from North America [cf. *R.A.M.*, viii, p. 413].

At the request of the Air Ministry an investigation was begun in 1924 to determine what fungus was responsible for the decay of Sitka spruce [*Picea sitchensis*] during transit to this country [ibid., vii, p. 354]; a number of fungi were isolated in pure culture and the principal one concerned in producing decay under these conditions was identified as *Trametes serialis* [cf. ibid., ii, p. 146],

this being later confirmed by the development of fruit bodies. A report on the action of this fungus on Sitka spruce is in preparation.

MOUNCE (IRENE). **Studies in forest pathology. II. The biology of Fomes pinicola (Sw.) Cooke.**—*Canada Dept. of Agric. Bull.* 111, N.S., 75 pp., 10 pl., 1929.

After noting the synonymy and geographical distribution of *Fomes pinicola* and listing 91 species of trees on which it has been recorded, usually as a saprophyte, the author gives a detailed account of her cultural studies of the fungus [*R.A.M.*, viii, p. 413]. Germination of the spores took place at temperatures ranging from 8° to 35° C. on numerous [listed] media, the optimum for growth being about 27° to 29°. Sporophores were obtained in cultures on malt and prune agar and on Czapek's synthetic liquid medium containing various substitutes for the dextrose of the formula, as well as on eleven varieties of coniferous and deciduous wood, rudimentary sporophores being formed on fourteen others. The context of the sporophores produced in culture was typical in colour and texture, and the spores were viable. A *Fomes* type of fruit body, with three definite pore layers each of which shed spores, was developed in a culture on wood of *Pinus divaricata*. Sporophore production was inhibited at 8°. The mycelium grew best at P_H 4·8 to 5·2. Young cultures of mycelia from different hosts differed from each other in rate of growth, colour production, and texture of the mycelial mat; older cultures tended to become more uniformly white and felted. These differences are attributed to individual variation rather than to host influence, since it was not found that one type of mycelium was constantly isolated from one type of fruit body, from one host, or from different hosts in one locality.

Mixed culture experiments showed that a line of aversion developed when mycelia of *F. pinicola* from different genera and species of deciduous and coniferous hosts were paired, when mycelia from the same host species but different localities were paired, and when mycelia from the same host species and the same locality were paired. It did not form when the two mycelia came from the same culture. It developed even when mycelia from sporophores growing on the same tree were used; its formation was independent of variations in temperature, light, and amount or kind of medium (provided this allowed normal mycelial development). It is considered probable that in paired cultures the effect of one mycelium upon another at the line of meeting disturbs the metabolism, and that the density of the line of demarcation may indicate the amount of this disturbance.

F. pinicola is undoubtedly heterothallic and bisexual. Paired cultures showed that the spores from a single fruit body fell into two groups; clamp-connexions were formed only when a member of one group was paired with a member of the opposite group. Monosporous mycelia kept in culture for five years remained in the haploid condition.

That *F. marginatus* and *F. pinicola* are one and the same species and that the European and American forms are identical was

shown by the fact that their monosporous mycelia were mutually fertile.

The macroscopic and microscopic characters of the timber rot caused by *F. pinicola* are described; typical rot was obtained in artificial cultures on wood.

A bibliography of 79 titles is appended.

Böhringer (W.). **Was der Landwirt von der Holzkonservierung wissen muss.** [What the farmer must know about wood preservation.]—*Illus. Landw. Zeit.*, xlix, 20, pp. 225–226, 1929.

Directions are given in popular terms for the impregnation of timber for agricultural purposes with various preparations in current use, e. g., copper sulphate, carbolineum, coloured carbolineum (Rütgers), and mixtures of sodium fluoride and dinitrophenol (sold under the name of Wolman salts) [*R.A.M.*, viii, p. 211].

Holzkonservierung mit Zinkmetaarsenit. [Wood preservation with zinc meta-arsenite.]—*Chem. Zeit.*, liii, 37, p. 366, 1929.

Investigations conducted by the Grubenholzimprägnierung G.m.b.H. [Mine Timber Impregnation Co., Ltd.], Berlin-Charlottenburg, have shown that the zinc meta-arsenite process of wood preservation fails to meet the claims made for it [*R.A.M.*, vii, p. 484]. Some 50 per cent. of the protective substance was leached out of treated pine wood by cold water, and no appreciable difference in toxicity towards a number of common wood-destroying fungi was found between zinc meta-arsenite and creosote. There is considered to be no basis whatever for the statement that zinc meta-arsenite is 30 times as toxic as creosote.

Howitt (J. E.), Sands (D. R.), & Jones (D. H.). **Fungus and bacterial diseases of vegetables.**—*Ontario Dept. of Agric. Bull.* 345, 64 pp., 8 pl., 23 figs., 1929.

Popular notes are given on the symptoms, etiology, and control of some well-known fungous and bacterial diseases of vegetables occurring in Ontario and other parts of Canada. Directions for the preparation of some standard fungicides and for soil sterilization are appended.

Diffloth (P.). **Les maladies du Chou.** [Cabbage diseases.]—*La Vie Agric. et Rurale*, xxxiii, 18, pp. 277–280, 4 figs., 1929.

In connexion with some brief popular notes on fungous diseases and insect pests of cabbage in France, the writer states that yellows (*Fusarium conglutinans*) was most destructive during the current season in all parts of the country. Preventive measures are concisely indicated.

Whitehead (T.) & Jones (W. A. P.). **'Dry rot' of Swedes.**—*Welsh Journ. of Agric.*, v, pp. 159–175, 3 pl., 2 diags., 1929.

After a brief account of the symptoms, cultural characters, and mode of infection of the causal organism of dry rot of swedes

(*Phoma lingam*) [*R.A.M.*, vii, p. 758], the writers discuss some important agricultural aspects of this disease, which is stated to be responsible for serious losses in many parts of the British Isles.

Soil contamination has been shown to be an important source of initial infection in the field. On many farms in North Wales diseased swedes are thrown on the manure heap, and this no doubt provides an effective means of starting a fresh outbreak in the next crop. The spores of the fungus have been shown in laboratory experiments to remain viable for three years. The risk of soil contamination through the use of diseased swedes as fodder for sheep was demonstrated on a Denbighshire farm, where a severe attack of dry rot occurred on previously healthy land as a result of this practice. Infection from other crops or weeds, or through the seed, is of minor importance in comparison with soil contamination in North Wales.

Experiments [which are fully described] indicated that the disease is disseminated in the field mainly by wind-borne spores. Infection has further been shown to spread from diseased to healthy swedes already placed in clamps. The fungus enters the host through lenticels, leaf scars, and wounds, but no evidence was obtained that it can penetrate the unbroken rind of the turnips. Leaf spots bearing pycnidia similar to those on the roots were observed in 1924, and cross-inoculations established the identity of the fungus in the two situations. The spots on the leaf are rather inconspicuous, pale green or grey, and may only become visible as the leaf withers. In a series of variety trials carried out in 1921, 1922, 1924, and 1928, the Lord Derby, Magnum Bonum, Pioneer, and Dreadnought swedes were found to be highly susceptible, while yellow turnips are resistant. Promising results were also given by the Danish varieties, Studsgaard and Herning.

The incidence of dry rot was scarcely affected, if at all, by the application of artificial fertilizers, e. g., sulphate of ammonia and sulphate of potash, possibly because the farm-yard manure given to all the crops may have masked their influence.

The roguing of infected plants in the field controlled the disease to some extent, and probably offers the most feasible means of eradication if begun in good time. The incidence of infection in one of the clamps was somewhat reduced by dressing the roots with ground limestone, but the degree of control was not sufficient to recommend this treatment for general use.

STAPP (C.) & KOTTE (W.). **Die Fettfleckenkrankheit der Bohne, eine für Deutschland neue, durch Bakterien hervorgerufene Pflanzenkrankheit.** [The grease spot disease of the Bean, a plant disease new to Germany, caused by bacteria.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst,* ix, 5, pp. 35–37, 5 figs., 1929.

Attention is drawn to the occurrence in two different parts of Germany (Baden and the neighbourhood of Berlin) during 1928 of the so-called 'grease spot' disease of beans [*Phaseolus vulgaris*], caused by the organism responsible for blight and wilt in New York (*Phytomonas* [*Bacterium*] *medicaginis* var. *phaseolicola*) [*R.A.M.*,

vi, p. 331], a technical description of which is given. Affected plants showed a mosaic-like yellow spotting of the pinnate leaves, followed by the development, in the centre of the lesions, of an area of a peculiar transparent consistency resembling that of tissue paper. A whitish, viscous exudate was observed on the spots in damp weather. On the stems the lesions were elongated, water soaked, and often surrounded by a narrow, reddish halo. From the pods the infection sometimes passed to the seeds, which developed water soaked, horny, brown, sunken spots. The most susceptible varieties were Hinrich's Riesen, Flageolet-Wachs, and Wachs Mont d'Or.

CARTER (W.). **Ecological studies of curly top of Sugar Beets.**—*Phytopath.*, xix, 5, pp. 467–477, 1 fig., 1929.

This is an extended account, accompanied by tabulated data, of the author's ecological studies on curly top of sugar beets in southern Idaho, a brief notice of which has already appeared [*R.A.M.*, vii, p. 295].

In one experiment, 15 plants were severely etiolated by six days' growth in a dark basement at 85° F., while 15 others were placed out of doors in a celluloid cage for the same length of time, at the end of which five infective leafhoppers (*Eutettix tenella*) were placed on each of the 30 plants. Three days later the etiolated plants were removed to another similarly situated celluloid cage. Only three cases of curly top occurred in the etiolated set compared with 15 in the outdoor lot, indicating that the condition to which the plant is exposed at the time of inoculation affects the number of positive cases even if subsequent conditions favour infection. Possibly the factors governing susceptibility to infection are not identical with those influencing the development of the disease. A higher percentage of plants developed curly top under celluloid and celoglas (a glass substitute) than under cloth or artificial light (1,000-watt Mazda or a quartz mercury-arc lamp).

Three pigments, viz., lampblack, zinc oxide, and hydrated lime were sprayed on the leaves of plants in the experimental plots in order to screen them from the light with a view to reducing infection. The first two disturbed the photosynthetic functions of the plants and caused a decrease of yield, while the last-named reduced the incidence of curly top without affecting the normal processes of the plants.

CARTER (W.). **The purpose of predicting outbreaks of Eutettix tenellus (Baker) under present-day conditions.**—*Journ. Econ. Entom.*, xxii, 1, pp. 154–158, 1929.

There are three types of district in Utah and Idaho for which predictions of outbreaks of the sugar beet leafhopper (*Eutettix tenella*) [*R.A.M.*, viii, p. 283] might be worked out. The first (probably comprising most of Utah) is that in which the territory contiguous to the beet fields is not a permanent breeding-ground of the insects, and where the crop often suffers as a result of

migration of the leafhoppers from distant areas. The second type, represented by the Cache Valley and the district of Idaho north of Idaho Falls, suffers to a still slighter extent than the foregoing from long-distance migrations. The third type, comprising the central portion of southern Idaho, is that in which the beet fields are situated in close proximity to the permanent breeding-grounds, the source of infestation, therefore, being definitely known. It is here that the prediction of outbreaks is a real necessity.

The problem of prediction is complicated by the hibernation of large leafhopper populations. To be of value to the industry the predictions of impending outbreaks should be issued not later than the end of February, yet it is almost impossible to make any reliable estimate of populations in the desert districts during the winter. In order to do this, environmental factors must be studied in very great detail, so that the probable success of hibernation may be estimated even during the period of inactivity of the insects.

The prediction of outbreaks in districts suffering from long-distance migrations is still further complicated by the need for an intimate knowledge of the factors influencing the flight to the beet fields. In order to recognize in good time the circumstances that lead to particular forms of damage, it is essential to investigate all the environmental factors susceptible of measurement and the relation of biological phenomena to them. Since a very large part of Utah is subject to damage from migration, an intensive study on these lines would doubtless be very profitable. It is unlikely, on the other hand, that much benefit would be derived from the application of these methods to the Cache Valley and other regions where injury due to leafhopper epidemics is not appreciable, the limiting factors in beet cultivation there being mainly agricultural.

Severin (H. H. P.). **Curly top symptoms on the Sugar Beet.**— *California Agric. Exper. Stat. Bull.* 465, 35 pp., 4 pl., 13 figs., 1929.

Sugar beets in California affected with curly top [see preceding abstracts] sometimes show on the leaves small blister-like elevations, which may form within two days of infection. A constant symptom of curly top is a transparent network of minute veins, generally on the youngest leaves; at first this symptom may be confined to part of the leaf, but in a few days it affects the whole. A diseased beet may retain the transparent venation during the whole season without showing any other symptom, and late infected beets suffering from lack of moisture may show them on the youngest leaves and nothing else.

Another constant symptom of curly top is the presence on the lower surface of the leaves, usually after the veinlets have become transparent, of numerous tiny, wart-like protuberances; as the disease progresses, ripple-like papillae and knot-like swellings, resembling galls, develop here and there on the distorted veins. The diseased leaves are dark green, thick, and brittle. The other

symptoms shown by affected plants have been fully described in earlier publications.

Field tests of the relation between irrigation and curly top showed that when the beet leafhoppers (*Eutettix tenella*) are exceptionally numerous, irrigation will not check the appearance of the symptoms in the interior of California, if the beets are late planted and badly affected. Early planted beets growing in rich soil usually respond to irrigation by vigorous growth, unless the outer leaves become badly sun-scorched. With early planted, diseased beets better yields can be obtained with repeated light furrow irrigations than with flooding.

Abnormal forms of beet foliage often confused with curly top are roll leaf, which is an inward rolling and puckering of the leaves; rosette, in which numerous dwarfed, flat leaves with short petioles form a rosette; downy mildew (*Peronospora schachtii*), causing dwarfing and curling of the inner leaves; and mosaic [ibid., i, p. 230; vi, p. 591], of which two types are found in California, mottled leaf and black edge or black tip. Leaf mottling of beets caused by mosaic may or may not be associated with malformation. The black tip form was noticed in the Santa Clara Valley in 1923. The leaf was spotted with small, pale yellow or white areas and large, irregular blotches; associated with this was a dwarfing and malformation of the leaves, which showed black tips or black edges, or both, while the blade was sometimes reduced to little more than a continuation of the petiole.

Beets apparently affected with another type of mosaic were also found, having filiform, curled, and malformed but not mottled leaves.

Successive generations of *E. tenella* non-infective as to curly top were fed on beets showing both types of mosaic and then transferred to healthy beets, but no curly top or mosaic developed.

Mosaic may be confused with injury to sugar beet leaves caused by the leafhopper *Empoasca flavescens*, which sucks the juice and produces irregular white areas.

Fields in which much curly top is present before or shortly after thinning should be ploughed under and replanted with crops resistant to or immune from the disease, such as cereals, lettuce, and the like. Beets which are diseased but not marketable should be harvested as early as possible, especially when the outer leaves become sun-scorched and barren patches appear in the field.

In localities where a certain amount of curly top is endemic and in years when there is no widespread outbreak, late planted beets are apt to be more severely affected than those planted early.

TERÉNYI (A.). **Die Bekämpfung des Wurzelbrandes der Zuckerrübe.** [The control of root rot of Sugar Beet.]—*Pflanzenbau*, v, 21–22, pp. 309–315, 1929.

The writer carried out a series of experiments at Budapest in 1927 and 1928 on the control of root rot of beets (*Phoma betae*, *Pythium de Baryanum*, and *Aphanomyces levis*) with a number of disinfectants [which are listed].

The seed-clusters were sown in sterile sand to determine the

extent of seed-borne infection, and in ordinary soil to ascertain the degree of soil infection. Both types of infection were found to be frequent. In sterile sand the percentage of diseased plants was reduced from 26 in the control to 6 in plants from seed dusted with porzol. In ordinary soil there were 39 per cent. diseased plants in the control, 25 in those dusted with tutan and 30 with porzol. Of the liquid treatments germisan and copper sulphate reduced infection from 18 to 10 per cent. in sand and uspulun-universal to 11 per cent., while in soil the reduction was from 40 per cent. in the control to 13 with uspulun-universal, 20 with germisan, and 29 with copper sulphate. The marked stimulatory effect of dusting with porzol (2 and 4 per cent.), or with tutan, tillantin R, and preparation 225 (all at 1 per cent.) is ascribed to their inhibitory action on the incipient stages of the disease; this effect, however, is not always maintained, since 70 to 80 per cent. of the dusted seedlings succumbed after the 22nd day from emergence. This stimulus of the dusts can only take effect in sand, possibly owing to the low adsorption capacity of this medium, which gives the minute quantities of the fungicide an opportunity of acting before solution.

The results of field experiments showed that secondary soil infection by *P. de Baryanum* played an important part in the incidence of root rot, and attempts were therefore made to reduce this source of contamination by liming the soil and raising the hydrogen-ion concentration from P_H 6·8 to 7·9. Although higher yields were obtained on the limed plots, this result is attributed to improved nutritional conditions rather than to an actual reduction of infection. Since it is obvious that the fungicides can only exercise their protective effects when the degree of soil infection is low, further efforts must be made to ensure these prerequisite conditions by suitable cultural measures.

GUYOT (A. L.). **De la lutte contre les maladies de la Betterave par la désinfection de la semence.** [On the control of Beet diseases by seed disinfection.]—Reprinted from *Bull. Soc. Centr. Agric. de la Seine-Inférieure,* 13 pp., 1929.

The author points out that while *Phoma betae* causes both blackleg and heart rot of beets, no further definite connexion has been established between the two conditions [*R.A.M.*, vi, pp. 529, 648], and that although heart rot is not necessarily very severe on beets previously attacked by blackleg, it can cause heavy losses even in fields where germination took place in the absence of the fungus.

Ramularia beticola and *Cercospora beticola,* which attack the green parts of beets, are also seed-borne; the former is generally a weak parasite, but the latter causes a serious leaf spot [ibid., vii, p. 695], distinct from, but sometimes confused with, mosaic or yellows [ibid., vi, p. 591].

Brief details are given of the effects of numerous [named] chemical seed disinfectants used against *P. betae*, their influence on the germinative power and energy of the beets being shown in tabular form [cf. ibid., viii, p. 8].

PLAUT (M.). **Wurzelbrand, Auflauf und Beizung von Rübensamen.** [Root rot, germination, and disinfection of Beet seed.]—*Nachr. über Schädlingsbekämpf.*, iv, 1, pp. 1–11, 7 figs., 2 graphs, 1929.

On the basis of data [which are tabulated] collected by himself and other workers, the author concludes that the disinfection of beet seed against root rot (*Phoma betae*, *Pythium de Baryanum*, and *Aphanomyces* [*levis*]), e. g., with uspulun-universal (0·25 per cent.), is profitable mainly on soils of abnormal or unsuitable composition [*R.A.M.*, viii, p. 418]. Sterile sand was found to be the best medium for germination in a recent series of experiments.

WELLMAN (F. L.). **A new disease of stored Onions found in Colorado.**—*Plant Disease Reporter*, xiii, 1, p. 2, 1929.

An apparently undescribed disease of stored onions was observed shortly before Christmas, 1928, in the Arkansas Valley region of Colorado. Affected bulbs show a dark discoloration of the neck, which exudes watery, dark brown drops on pressure. This symptom has suggested the local name of 'bloody nose' for the disease. A species of *Fusarium* consistently isolated from infected material and found to be pathogenic on onion bulbs is believed to be the cause of the condition. The fungus may only attack a few internal scales situated in any part of the bulb, causing them to become darkened and tender, while the rest of the bulb remains firm. This disease has affected stored onions of the Mountain Danners, Yellow or White Valencia, and Giant Gibraltar varieties (90 per cent. in the last-named in one year). The estimated losses for the current season range from a trace to 40 per cent.

SARTORY (A.), SARTORY (R.), & MEYER (J.). **Une maladie du Melon (Citrullus vulgaris) occasionnée par un Fusarium et une bactérie chromogène.** [A disease of the Melon (*Citrullus vulgaris*) caused by a *Fusarium* and a chromogenic bacterium.]—*Comptes rendus Acad. des Sciences*, clxxxviii, 22, pp. 1434–1436, 1929.

Watermelons in the south of France have been attacked by a disease characterized by the development of extensive orange patches on the fruits, which subsequently become ruptured owing to the abundant formation of gas in the tissues. A species of *Fusarium* and a bacterium were isolated from the infected tissues [*R.A.M.*, viii, p. 481] and grown on media with a cellulose base, but the latter was not attacked by the bacterium under either aerobic or anaerobic conditions, whereas the fungus showed a definitely cellulolytic action. Inoculation experiments on bananas and melons with the bacterium alone gave negative results, but the typical symptoms of the disease were produced when the fruits were inoculated first with the fungus and then with the bacterium, the former alone being capable of penetrating through the cell walls of the fruit. The bacterium is irregularly rod-shaped, 0·7 to 1·5 μ long, motile, and furnished with numerous flagella. It is Gram-negative, does not liquefy gelatine, form gas, or coagulate milk; the optimum temperature for growth is about 27° C., but satisfactory development occurs also at 37°. The optimum hydrogen-

ion concentration is P_H 6·4. On bouillon, agar, or gelatine, containing carbohydrates, e. g., glucose or glycerine, and mineral salts such as dicalcium phosphate, magnesium sulphate, and sodium chloride, producing a reaction below P_H 6·8, a reddish-purple pigmentation developed. This was absent on media with a hydrogen-ion concentration above P_H 6·8 and a temperature below 32°, under which conditions the cultures assumed a yellowish-green coloration. The chromogenic substance is soluble in water, alcohol, acetone, and glycerine but not in chloroform, ether, &c.; it may be induced to develop in apparently non-chromogenic cultures by the addition of acetic acid, weak organic acids, ammonia, or soda, as well as by heating.

In its tendency to pigmentation, solubility in water, insolubility in chloroform, and absence of fluorescence the melon bacterium is clearly distinguishable from the groups represented by *Bacillus prodigiosus* on the one hand and *B. pyocyaneus* on the other.

Studies on the fungus are in progress.

HIURA (M.). **Studies on some downy mildews of agricultural plants. II. Relation of meteorological conditions to the downy mildew of Cucumber.**—*Res. Bull. Gifu Imper. Coll. of Agric.*, 6, 58 pp., 1929. [Japanese, with English summary.]

Near Gifu, in the province of Mino, Honshu (Japan), downy mildew of cucumbers [*Pseudoperonospora cubensis*: *R.A.M.*, vii, p. 295] becomes prevalent at the end of June and generally declines to a marked extent from the middle of July onwards when the temperature reaches 30° C. The inception of the disease is greatly influenced both by rainfall and temperature, the minimum temperature necessary for primary infection being about 10° to 15°, and the optimum for development of the disease approximately 20°. A moderate (but not excessive) rainfall also contributes to the occurrence of infection, which may fail to develop altogether in the complete absence of precipitation. Field observations from 1925 to 1928 indicated that the first symptoms of downy mildew usually appear about the end of May, but their development may be expedited or delayed by abnormally high or low temperatures, respectively.

The optimum temperature for conidial production and germination was found to be from 15° to 19°. The maximum temperature for production is 27° and for germination 30° to 32°, and the corresponding minima are below 10° and 4°, respectively.

NOLLA (J. A. B.). **The Eggplant blight and fruit rot in Porto Rico.**—*Journ. Dept. Agric. Porto Rico,* xiii, 1, pp. 35–57, 4 pl., 1929.

The blight and fruit rot of eggplants caused by *Phomopsis vexans* [*R.A.M.*, i, p. 197; iv, p. 138] is stated to be serious in Porto Rico, where it usually causes a loss of 50 per cent. or more of the crop. The symptoms [a description of which is given] appear on all the aerial parts of the plant and on both seedlings and adults. All the varieties of eggplant tested in Porto Rico proved to be more or less equally susceptible. In giving a brief account of the morphology of *P. vexans* [Harter's technical description of

which is reproduced], the author states that he did not observe in his cultures the same variations as have been reported elsewhere; B spores (stylospores) were infrequent and the size of the pycnospores (A spores) ranged from 5 to 8 by 1·3 to 3 μ. Infection of the host may occur through a stoma, a wound, or through the uninjured cuticle.

The main lines of control recommended are based on the fact that the fungus is seed-borne and that it is capable of a saprophytic existence in the soil. It is thought probable that the disease may be controlled by a three- or four-years' crop rotation. The soil of seed-beds should be drenched with a 2 per cent. formaldehyde solution at the rate of half a gallon per square foot. Seed disinfection is never entirely effective, and the use of seed from healthy plants is therefore recommended. Bordeaux mixture (4–4–50) is quite effective in the control of the seedling blight caused by *P. vexans*, but its cost is prohibitive under ordinary conditions.

BACHALA (A.). **La protection du vignoble contre les invasions de mildiou, de black-rot et de l'oidium dans le sud-ouest.** [The protection of the vineyard against invasion by mildew, black rot, and *Oidium* in the south-west.]—*Prog. Agric. et Vitic.*, xci, 19, pp. 450–458, 1929.

Brief popular notes are given on the symptoms, predisposing causes, and control of downy mildew (*Plasmopara viticola*), black rot (*Guignardia bidwellii*), and powdery mildew (*Uncinula spiralis*) [*U. necator*] of the vine; the composition of various spray mixtures and powders used against these diseases is indicated and directions are given as to the times at which they should be applied.

LIBUTTI (D.). **Trattamenti antiperonosporici e solforazioni.** [Anti-mildew treatments and sulphur applications.]—*L'Istria Agric.*, N.S., ix, 9, pp. 188–191, 1929.

Popular notes are given on the control of vine *Peronospora* [*Plasmopara viticola*: *R.A.M.*, viii, pp. 150, 287] and *Oidium* [*Uncinula necator*] in Italy. The first treatment against *P. viticola* should be given as soon as infection is noted on the most susceptible vines, 1 per cent. Bordeaux mixture or Caffaro powder being adequate in most cases, though this concentration should be increased to 1·5 per cent. in severe attacks or persistently rainy weather; in very serious epidemics 125 gm. of carbonate of ammonia or 150 gm. of sulphate of ammonia dissolved in a few litres of hot water should be added to each hectolitre of the mixture, or, if preferred, 100 gm. of neutral copper sulphate to the same quantity, to make the mixture slightly acid [ibid., vii, p. 8].

In average seasons 3 applications are considered to afford sufficient protection: the first should be given when the young shoots are 15 to 20 cm. long, the second during the first fortnight in June, and the third during the second fortnight in July. Further treatments are indicated when the weather favours infection.

Treatments directed against both diseases simultaneously may

be made by alternating liquid applications with dusts, such as 3 to 5 per cent. cupric sulphur [ibid., i, p. 66] or ordinary sulphur containing 10 to 15 per cent. Caffaro powder. The first dust application against *U. necator* should be made in May, the second after the first liquid treatment, the third during flowering, and the fourth when the berries are the size of peas. Further applications may be made to the fruit clusters if necessary.

MÜLLER (K.). **Verzögert nosprasen die Reife der Trauben?** [Does nosprasen retard the ripening of Grapes?]—*Nachr. über Schädlingsbekämpf.*, iv, 1, pp. 27–28, 1929.

The results of experiments conducted by the author in 1927 and 1928 lend no support to the view that nosprasen, applied for the control of *Peronospora* [*Plasmopara viticola*: *R.A.M.*, viii, p. 85], retards the ripening of the grapes on sprayed vines. There was no difference in this respect between the plots treated with nosprasen (1·5 per cent.) and those receiving 1 per cent. Bordeaux mixture, but the former gave a higher yield and (in one case) a heavier must weight and lower acid content.

JACOB (H. E.). **Powdery mildew of the Grape and its control in California.**—*California Agric. Extens. Serv. Circ.* 31, 18 pp., 7 figs., 1929.

In this circular an account is given in popular terms of the symptoms and nature of powdery mildew (*Uncinula necator*), which is stated to be the most serious disease of the vine in California, together with full notes on the preventive and curative methods advised for its control.

There is much difference in the susceptibility of vines to powdery mildew. All the American species (*Vitis labrusca*, *V. riparia*, *V. rupestris*, etc.), are much less susceptible than *V. vinifera*, while the most resistant varieties of the latter are Beclan, Alicante Bouschet, Mataro, and Petite Sirah (Duriff).

The fungus grows at any temperature between 50° and 100° F.; growth is rapid at 75°, and reaches a maximum at between 90° and 95° if the air is sufficiently moist.

Under Californian conditions 3 to 5 applications of sulphur dust are generally sufficient to prevent the spread of the disease, the first being given when the shoots are 6 to 8 in. long, the second when they are 15 to 18 in. long, the third when they are 2 to 3 ft. long, the fourth when the berries are well set, and the fifth when they have reached about one-half their full size.

If the vines are of average size, and provided that the dusting apparatus is efficient, 5 to 15 lb. of sulphur per acre are used at each application. If the temperature of the air exceeds 100°, excessive quantities of sulphur may cause burning.

A spray composed of 1 lb. potassium permanganate in 75 galls. water with a sodium silicate and baking powder spreader will kill the fungus without injuring the vines or causing much staining of the fruit; this spray should be followed by an application of sulphur soon after the vines are dry.

MUSIANI (A.). **Conviene usare lo zolfo puro contro l'oidio della Vite?** [Should pure sulphur be used against *Oidium* of the Vine?]—*L'Istria Agric.*, N.S., ix, 9, pp. 194–195, 1929.

The author urges that, on the ground of economy, the use of refined sulphur for the control of vine *Oidium* [*Uncinula necator*] should be discontinued in favour of fine dusts containing not less than 30 per cent. sulphur mixed with some inert material. Ever since the first appearance of the disease, growers in Tuscany have obtained satisfactory control with such mixtures containing 30 to 40 per cent. sulphur, while since 1867 growers in the Campania, where the warm, wet springs favour infection, have secured adequate protection by the use of the natural sulphur from Altavilla Irpina, which is the raw material finely ground, and contains only 30 per cent. sulphur. The wind-blown, natural sulphur from the same locality [cf. *R.A.M.*, viii, p. 545] is readily obtainable as a commercial product, and applied in the same quantities as the refined form gives equally good and even speedier results at a far smaller cost. Another form of natural, wind-blown sulphur is 'Ventilato Romagna M.S.R.'

A mixture of lime with 40 to 50 per cent. sulphur is stated to give excellent results.

ZILLIG (H.) & NIEMEYER (L.). **Beiträge zur Biologie und Bekämpfung des Roten Brenners (Pseudopeziza tracheiphila Müller-Thurgau) des Weinstocks.** [Contributions to the biology and control of the 'roter brenner' (*Pseudopeziza tracheiphila* Müller-Thurgau) of the Vine.]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xvii, 1, pp. 1–66, 4 pl. (1 col.), 1 fig., 3 diags., 1929.

This is an expanded account of the writers' researches, extending from 1923 to 1928, on the morphology, biology, and control of the 'roter brenner' disease of the vine (*Pseudopeziza tracheiphila*) in the Moselle, Saar, and Ruwer Valleys (Germany), a preliminary popular note on the practical aspects of which has already been published [*R.A.M.*, vi, p. 711].

None of the numerous [listed] species and varieties of *Vitis* (including American vines and hybrids) showed immunity from, or even a high degree of resistance to *P. tracheiphila* in the authors' field observations and inoculation tests. Infection was also noticed on *Ampelopsis* [*Parthenocissus*] *quinquefolia* and *A. veitchii* [*P. tricuspidata*], which do not seem to have been previously recorded as hosts of the fungus.

An examination of the tissues of diseased vines showed that the mycelium was present only in the leaves and petioles, seldom extending to the base of the latter, while studies on heavily infected pot vines indicated that the fungus overwinters almost exclusively in the fallen foliage.

The optimum temperature for the development of the mycelium and apothecia on the host plant, and also for infection of the latter lies between 18° and 20° C. On old leaves the apothecia may begin to develop at 13°; at 27° their growth is arrested and at 52° it ceases. The germination of the ascospores begins below 10° and decreases considerably above 27°. In contrast to *Perono-*

spora [*Plasmopara viticola*], the previous wetting of the leaves by dew or rain is not essential to infection.

The fungus was grown in pure culture from mycelium and ascospores but no apothecia were developed under these conditions. In plate cultures the mycelium proved resistant to several hours' freezing at $-20 \cdot 5°$ C., followed by thawing, while within the vine leaf it is capable of surviving the natural occurrence of frost and of heat up to 52°, storage under dry conditions for at least $2\frac{3}{4}$ years, and absence of oxygen for 83 days. A mixture of 80 c.c. *Ampelopsis* extract (1 : 10), 20 c.c. distilled water, and 15 gm. of gelatine was found to be a particularly suitable medium for the development of the mycelium of *P. tracheiphila*.

Apothecial growth was not influenced by light. As many as 330 apothecia were found on a square centimetre of an old Elbling leaf, giving rise to some 353,760 ascospores. These are the chief agents in the dissemination of the disease, as they are ejected when ripe, under suitable external conditions, to a height of 2 cm. above the apothecia. It was further observed that conidia were formed on diseased leaves during the summer, and assist in the spread of infection. They are borne on short conidiophores, 15 to 25 μ high, which burst through the epidermis as swollen cells from which 1 to 3 stalks arise. The stalks are branched at the tip and each branch bears the conidia, which are not abstricted but ejected from within the tip of the conidiophore one after another; germination was induced only in a few isolated instances and the factors governing the length of the incubation period and the occurrence of conidial infection are not yet fully understood. Numerous inoculation experiments on European and American vines showed that the average incubation period of ascosporal infection is three to four weeks. The relative susceptibility of the Riesling and Elbling varieties was estimated at about 85 : 100. A plentiful supply of water and food retarded the development of 'roter brenner', which flourished on vines kept under dry conditions.

The results of greenhouse and field experiments demonstrated the efficacy of spraying the newly unfurled vine leaves with 1 to 1·5 per cent. Bordeaux mixture or an equivalent copper-containing preparation as a means of control [ibid., vii, p. 698]. Under weather conditions favouring the development of the apothecia, a second application of the fungicide should be given after an interval of 8 to 10 days.

HIGGINS (B. B.). **Morphology and life-history of some Ascomycetes with special reference to the presence and function of spermatia. II.**—*Amer. Journ. of Botany*, xvi, 5, pp. 287–296, 1 pl., 1 fig., 1929.

Observations on the occurrence of *Cercospora viticola* on vine leaves at the Georgia Agricultural Experiment Station [*R.A.M.*, viii, p. 90] have been restricted to a few varieties of *Vitis vinifera* and *V. labrusca*, one of *V. riparia*, and a number of *V. rotundifolia*. The last-named is apparently quite immune from infection by *C. viticola*, while all the cultivated and wild varieties of *V. labrusca* are very susceptible.

Black, ovate to globose spermogonia, measuring 36 to 60 by 42

to 60 μ, and containing small rod-shaped spermatia 2 to 3 by 1 μ, are formed in great profusion on dead infected leaves throughout the autumn. Somewhat later, usually during the latter part of October, black, subglobose perithecia, 60 to 91 by 60 to 89 μ, begin to develop. In the young perithecium a nucleus passes from the degenerating trichogyne into the enlarged basal uninucleate part of the carpogonium. This nucleus may possibly come from a spermatium, but attempts to germinate the spermatia failed.

Cultures from conidia and from the hyaline, clavate to cylindrical, straight or slightly curved, bicellular ascospores, measuring 10·5 to 22 by 2·5 to 3·6 μ, were similar in all respects. Uninjured vine leaves were readily infected by placing either conidia or ascospores directly on the surface. Inoculation experiments with mycelium from cultures, however, gave uniformly negative results, indicating that the mycelium loses its virulence as a consequence of growth on artificial media, as previously reported for *Mycosphaerella bolleana* on fig (*Amer. Journ. of Botany*, vii, p. 435, 1920).

The perfect stage of the fungus is named *M. personata* n. sp., with diagnoses in English and Latin.

Mathieu (L.). **Microorganismes des caves à vin.** [Micro-organisms of wine-cellars.]—*Rev. de Vitic.*, lxx, 1822, pp. 345–349, 1929.

The author emphasizes the disadvantages attendant upon the abundant growth of mould fungi (including *Botrytis cinerea*, *Penicillium glaucum*, *Aspergillus niger*, *Dematium pullulans*, *Cladosporium herbarum*, and *Merulius lacrymans*) in wine-cellars, in particular on account of the unpleasant odours they (especially *P. glaucum*) impart to the cellars and the wine contained therein, even when the latter is bottled. Anaerobic forms of the Mucoraceae develop in wine, and being plainly visible reduce its market value, especially as regards sparkling wines. Instances were observed in which 20 per cent. of various consignments of bottled sparkling wines had to be rejected on this account, the fungi being introduced on corks washed in contaminated tubs. Wine-cellars and all utensils and implements should be regularly cleaned and disinfected, and bottling methods [which are indicated] introduced designed to avoid contamination from the air.

Palestine Grapes. Experimental Shipment No. II, August, 1928.—*Palestine Dept. of Agric. and Forests, Agric. Leaflets*, Ser. iv (*Hort.*), 17, 59 pp., 4 graphs, 1929.

The first section of this report contains some general observations on the packing, transport, varietal behaviour, and condition on arrival of an experimental consignment of grapes dispatched to England from Palestine towards the end of July, 1928. In the second part (by Dr. I. Reichert and Dr. F. Littauer), the results are given in detail of the examination of these grapes by the Imperial Bureau of Mycology, and of similar samples kept in cold storage at Tel-Aviv.

On the whole, the external appearance and flavour of the grapes were satisfactory, but considerable losses were sustained both

through rot and through dropping of the berries from the bunch. The fungi chiefly implicated in the decay of the grapes were *Mucor* spp., *Rhizopus nigricans*, *Aspergillus niger*, a species of *Penicillium* closely related to *P. decumbens*, an *Alternaria* of the *A. tenuis* group, a *Stemphylium*, a green strain of *Cladosporium herbarum*, and a sterile mycelium associated with a bluish-black discoloration of the berries. The incidence of rot was apparently increased by moisture in the packing material, the maximum amount of decay occurring in dew-covered fruit picked early in the morning and packed in undried cork. The best results were obtained by picking at noon and then exposing the grapes for 24 hours before packing. Dropping is apparently due to physiological causes, such as over-maturity, defective ventilation, pressure, and possibly varietal characters [cf. *R.A.M.*, viii, p. 51].

MARCHAL (E.). **Résumé des observations phytopathologiques faites de 1920 à 1926.** [Summary of phytopathological observations made from 1920 to 1926.]—*Annuaire Stat. Agron. de l'Etat, Gembloux, Bull.* 2, 14 pp., 1928. [Received September, 1929.]

Apart from those already noticed from another source [*R.A.M.*, vi, p. 258] this bulletin contains the following new records made at the Phytopathological Station, Gembloux, Belgium. In 1925 seedling blight of flax (*Colletotrichum lini*) was first observed in Flanders and in the vicinity of Gembloux; in the same year *Bacillus janthinus* was found in the outer leaf sheaths of leeks, which showed a deep, violet-blue discoloration. This is stated to be the first record of this organism in living plant tissues. A severe attack of *Fusarium nivale* [? *niveum*] occurred on *Cucurbita pepo*.

Cultures of diseased material of the die-back of elms [ibid., viii, p. 343] on various media gave rise to the characteristic zonate colonies of *Graphium ulmi*; the author observed the germination of the spores on the stigmata of elm flowers and the penetration of the mycelium into the ovaries. Cultures of fungi present in the breeding galleries of the Scolytid beetles which infest the diseased elms gave rise to colonies closely resembling those of *G. ulmi*. The author therefore considers that these insects may be the vectors of the fungus and cause infection by bringing about conditions which are not set up by artificial inoculations.

VENKATA RAO (M. K.). **Report of the Mycological Section for the year 1927–1928.**—*Admin. Rept. Agric. Dept. Mysore for the year 1927–28*, pp. 19–22, 1929.

Generally speaking, the early development of the koleroga disease of areca palms [*Phytophthora arecae*] has been arrested by the cumulative effects of several years' consecutive spraying. During the period under review, sufficient materials for spraying an area of nearly 5,000 acres were purchased by garden owners. Extensive trials with the alum Bordeaux mixture [*R.A.M.*, vii, p. 442] gave very satisfactory results, and this preparation will be applied over an area of nearly 300 acres during the coming season at a saving of Rs. 1·9 [about 2*s.* 3*d.*] per acre as compared with casein-Bordeaux.

The total area treated against black rot of coffee [*Corticium koleroga*: ibid., viii, p. 443] is estimated at 500 acres.

A species of *Phytophthora* has been determined as the cause of a wilt disease of pepper [*Piper nigrum*].

PATEL (M. K.). **Biological studies of Pseudomonas tumefaciens Sm. & Town. and fifteen related non-pathogenic organisms.** —*Iowa State Coll. Journ. of Sci.*, iii, 3, pp. 271–298, 1929.

In this paper the writer discusses and tabulates the results of his biological studies on 15 non-pathogenic organisms allied to *Pseudomonas* [*Bacterium*] *tumefaciens*, isolated from some 200 overgrowths of the 'woolly knot' type on piece-root grafted young apple trees [*R.A.M.*, viii, pp. 249, 429].

Morphologically, the non-pathogenic organisms were found to be indistinguishable from *Bact. tumefaciens.* On the basis of serological agglutination tests, using anti-serum (*a*) from one of the non-pathogenic organisms, and (*b*) from *Bact. tumefaciens*, the bacteria were divided into two groups according to whether they did or did not agglutinate. The former group comprises nine non-pathogenic organisms, *Bacillus radiobacter*, and two strains of *Bact. tumefaciens*, while the latter contains the remaining six non-pathogenic organisms, six strains of *Bact. tumefaciens*, and *Rhizobium leguminosarum.* Agglutination tests with both the anti-sera failed to separate the non-pathogenic organisms from the strains of *Bact. tumefaciens.* Serum produced with the raspberry strain of the crown gall organism did not agglutinate the strains isolated from apple, almond, walnut, geranium, incense cedar (*Libocedrus decurrens*), and rose.

It is pointed out that the non-pathogenic organisms, having so many characteristics in common with the ill-defined group species, *B. radiobacter*, may well belong to the latter, as also may certain apparently non-pathogenic strains of *Bact. tumefaciens.* Pending the discovery of better means of determination it seems advisable to rely mainly on gall-producing capacity as a mark of identification with *Bact. tumefaciens*.

GOULDEN (C. H.) & NEATBY (K. W.). **A study of disease resistance and other varietal characters of Wheat. Application of the analysis of variance, and correlation.**—*Scient. Agric.*, ix, 9, pp. 575–586, 1929.

The essential problem in variety testing is defined as the determination of inherent differences between the varietal units, the test being efficient or otherwise according as the measurable effects of such differences are large or small compared with the variations arising from experimental error. On this basis the analysis of variance, as developed by Fisher ('Statistical Methods for Research Workers,' Oliver & Boyd, Edinburgh), may be used to furnish valuable information as to the nature of a particular variety test, and it will further serve to detect the presence of varietal differences. These will be significantly greater than the fluctuations due to experimental error only where real inherent differences exist between the varieties.

In connexion with their studies on the inheritance of resistance

to black stem rust [*Puccinia graminis*] of 86 strains from a cross between H-44-24 and Marquis wheats [*R.A.M.*, viii, p. 29], the writers observed that in 1928 the progeny of this cross were severely infected by a disease believed to be identical with black chaff (*Bacterium translucens* var. *undulosum*) [ibid., vi, p. 272]. Since these hybrids inherited the mature plant type of rust resistance from the H-44-24 parent, which is susceptible to black chaff, it was thought that a close linkage might exist between the factors for susceptibility to black chaff and resistance to rust. Susceptibility to black chaff was found to vary considerably from plot to plot, and it was impossible to determine from observation whether there were any real inherent differences between the strains in this respect. A second group of strains consisting of 46 pure lines of Marquillo wheat was found to be even more severely affected by black chaff than the hybrids. To both these groups the analysis of variance was applied. Clear evidence was obtained that there are real inherent differences for resistance to black chaff in both groups of strains, but if there is a linkage between resistance to stem rust and susceptibility to black chaff in the hybrids it is evidently incomplete.

An examination of the correlation coefficients [which are tabulated] between yield and the five variable factors, viz., earliness, height, strength of straw, seed weight, and black chaff, showed that in the Marquillo strains, yield is significantly correlated with black chaff, seed weight, and height, and in the hybrids with black chaff, seed weight, height, and earliness. The correlations between black chaff and yield were to be expected considering the conspicuous effects of the disease on the general condition of the plants. They indicate the economic value of resistance to black chaff should the disease become epidemic.

Shitikova-Roussakova (Mme A.). Сравнение особенностей развития ржавчины на Восточном и Западном полях Ставропольской С. Хоз. Оп. Станции в **1927** г. [Comparison of the peculiarities of rust development on the eastern and western fields of the Stavropol Agric. Exper. Stat. in 1927.]—*Materials for Mycol. and Phytopath.*, Leningrad, vii, 1, pp. 208–239, 1928. [Received August, 1929.]

Although only about seven miles distant from each other the eastern and the western fields of the Stavropol [north Caucasus] Agricultural Experiment Station show appreciable differences in their topographical, climatic, and ecological characters: the former lies at an altitude of 480 m. and belongs to the grass or grass-wormwood steppe type of vegetation, while the latter is roughly 150 m. higher, on the slopes of the foot-hills, and belongs to the wooded steppe type; the annual mean temperature is 1·4° [C.] higher and the rainfall 18 per cent. lower on the eastern than on the western field. A detailed study of the development of cereal rusts in both fields in 1927 was undertaken in view of unpublished data which showed that, corresponding to these different regional characters, marked differences also exist in the incidence and intensity of the rusts in the two areas: as a general rule, wheat

suffers much more from rust in the western than in the eastern field.

Puccinia triticina and *P. glumarum* of wheat, and *P. dispersa* [*P. secalina*] of rye overwintered better in the western than in the eastern field, owing to the fact that in the former the snow cover persisted for ten weeks as against four weeks in the latter. The incidence of *P. triticina* in both fields was about twice as high on wheats sown early in the autumn as on those sown later, and it was noted that the denser the stands the higher was the level of the rusted leaves on the stems. The number of rusted plants was about 33 per cent. lower in the eastern than in the western field. *P. triticina* overwintered least successfully on the selections *Triticum erythrospermum* 193 and 148, which were also the least winter resistant. Towards the end of the growing period the incidence and intensity of the rust were nearly 1·5 times as high in the western as in the eastern field. *P. glumarum* f. *tritici* was much less prevalent than *P. triticina*, but was again more severe in the western field. *P. graminis* f. *tritici* only developed in this field towards the end of the growing period. *P. glumarum* f. *hordei* on barley was present to a small degree in both fields and only on a few varieties. *P. simplex* [*P. anomala*] on this host was much more severe in the western than in the eastern field, although the alternate host (*Ornithogalum narbonnense*) only occurs in the latter; this would indicate that the spring development of *P. anomala* is ensured by successful overwintering of the parasite as mycelium in the barley leaves rather than by the existence of the alternate host. It was noted, however, that other heteroecious rusts, namely, *P. graminis* f. *tritici*, *P. graminis* f. *secalis*, *P. graminis* f. *avenae*, and *P. coronifera* [*P. lolii*], developed to a greater extent in the western field, where their alternate hosts (barberry and *Rhamnus cathartica*) are fairly numerous.

NEWTON (MARGARET), JOHNSON (T.), & BROWN (A. M.). **Reactions of Wheat varieties in the seedling stage to physiologic forms of Puccinia graminis tritici.**—*Scient. Agric.*, ix, 10, pp. 656–661, 1929.

A table is given showing the reaction of 33 wheat varieties and hybrid strains in the seedling stage to 22 physiological forms of stem rust (*Puccinia graminis tritici*) prevalent in Canada [*R.A.M.*, viii, p. 365].

The group of varieties possessing little or no resistance to any of the physiological forms used in the tests (representing all those occurring in appreciable amounts of recent years) includes Little Club, Chul, Garnet, Ruby, 682–B, and Pelissier. Acme, Kubanka, and Monad also show little capacity for resistance, but it must be remembered in this connexion that the reaction of seedlings and mature plants to a given parasite is not always identical [ibid., viii, p. 30]. However, experimental evidence obtained at the Rust Research Laboratory indicates that varieties resistant in the seedling stage normally remain resistant at maturity [ibid., viii, p. 491].

The varieties comprised in the second group, including Parker's Power, Quality, Renfrew, Reward, and Supreme, are closely allied

to Marquis in respect of rust reaction. Marquillo also resembles Marquis in its reaction to most of the forms, but it is highly resistant to forms 21 and 29 which cause severe infection on Marquis. Sevier × Dicklow, Webster, and Black Persian react with striking uniformity to all the physiological forms, the last-named being decidedly resistant, while the other two are near the border-line between resistance and susceptibility.

In another group are included the closely related varieties Hope and H–44–24 [see next abstract], which are highly resistant to most of the forms, while any pustules that develop (especially in the latter) are accompanied by pronounced chlorosis. Ceres, Kota, and some other varieties fall in this group.

In the last group are Kanred, Vernal, Khapli, and other resistant forms. The double crosses, 806–6 and 825–2 (selections from a cross between Marquis × Jumillo and Marquis × Kanred), are immune from the same forms of *P. graminis* as the Kanred parent, in addition to forms 33 and 34, to which Kanred is susceptible. These hybrids do not appear to be truly susceptible to any of the physiological forms. Jumillo is the only variety immune from all the forms, though Khapli shows a high degree of resistance.

Two disease-resistant Wheats.—*Plant Disease Reporter*, xiii, 3, p. 29, 1929. [Mimeographed.]

According to a leaflet by J. A. Clark (Office of Cereal Crops and Diseases, 25th May, 1929), two new hybrid wheat selections, Hope and H–44, are reported to be immune from stem rust and loose smut [*Puccinia graminis* and *Ustilago tritici*] and resistant to leaf rust and bunt [*P. triticina* and *Tilletia foetens*: *R.A.M.*, vii, p. 433]. These wheats are selections from a cross of Marquis on Yaroslav emmer made in 1916. They compare favourably in yield with other improved varieties, while Hope has also given satisfactory results in baking and milling tests.

WATERHOUSE (W. L.). **A preliminary account of the origin of two new Australian physiologic forms of Puccinia graminis tritici.**—*Proc. Linnean Soc. New South Wales*, liv, 2, pp. 96–106, 1 pl., 1929.

Wheat straw infected with the uredo- and teleutospore stages of *Puccinia graminis tritici* form 34 [*R.A.M.*, ii, p. 158; viii, p. 365] was collected from Werribee, Victoria, and Bathurst, New South Wales, while similar material infected with a mixture of forms 34 and 43 was obtained from Grafton, New South Wales, during the autumn of 1927. Successful barberry infections were secured in the spring of 1928 by mass inoculation with teleutosori attached to the straw [ibid., i, p. 241].

The Werribee and Bathurst rusts produced aecidia normally on some of the barberry shoots, though in some cases spermogonia alone were formed, while the Grafton one gave rise to spermogonia only. However, when spermatia of the Werribee and Bathurst rusts, respectively, were smeared over the spermogonia of the Grafton rust, the latter developed aecidia; the spermogonial pus-

tules of the other two rusts smeared with spermatia of the Grafton form also developed aecidia. Aecidiospores from the aecidia that developed in smeared pustules of the Werribee and Bathurst rusts developed uredospore cultures on wheat which proved to be mixtures of forms 11 and 34. Aecidiospores from the smeared Grafton rust pustules yielded a uredospore culture which appears to be a new form of *P. graminis*, resembling 34 except that the three durum wheats, Arnautka, Mindum, and Arnautka C.I. 6236 are markedly resistant to it instead of highly susceptible. Form 11 and the new form thus apparently originated in the aecidial stage of the fungus on barberry, presumably as a result of mixing the spermatia of form 43 with those of 34 and 43.

Craigie has drawn attention [ibid., vii, p. 47] to the importance of insects in the transference of spermatia, with consequent aecidial production. If such transference leads to the development of new physiological forms, the latter would naturally be more numerous where barberries are plentiful, e. g., in North America, than where they are scanty, as in Australia. This discovery of the origin of physiological forms on the barberry is considered to afford a strong reason for its eradication.

ROUSSAKOFF (L. F.) & POKROVSKY (A.). Бурая ржавчина на яровых Пшеницах Омского Участка Сортоиспытания В. И. П. Б. и Н. К. в **1928** году. [Brown rust on spring Wheats of the Omsk Variety Testing Section of the Pan-Soviet Union Institute of Applied Botany and New Cultures in 1928.]—*Materials for Mycol. and Phytopath.*, Leningrad, vii, 1, pp. 240–272, 1928. [Received August, 1929.]

In contrast to former years, 1928 was marked by a heavy outbreak of brown rust (*Puccinia triticina*) on spring wheats in the neighbourhood of Omsk [south-west Siberia], mainly owing to the very successful overwintering of the rust on the winter wheat crops and to the abnormally high rainfall during the whole period from May to July, inclusive. This permitted a detailed study of the reaction to this rust of all the wheat varieties grown at the Variety Testing Station [a full discussion of which is given]. Hard wheats, as a class, again proved much more resistant than the soft, and although under normal conditions their productivity is about 10 per cent. lower than that of the latter, in 1928 their average yield was about 41 per cent. higher. A peculiar feature was that, while the uredo stage of the rust was very little in evidence on the leaves, the teleuto stage began to appear very early (about a week before the emergence of the ears from the sheath), and attained a high degree of intensity towards the end of the growing period. This fact leads the authors to advise that the development of the winter stage of *P. triticina* should be given more consideration than hitherto in the classification of hard wheats for rust resistance. In soft wheats a close correlation was found between yield, on the one hand, and the area of leaf surface killed by the fungus as well as the length of their growing period, on the other hand.

The relative resistance of the varieties tested and their yield are given in tabular form.

GRAM (E.). **Afsvampningsundersøgelser. III. Korn og Graesfrø.** [Disinfection experiments. III. Cereal and grass seed.]—*Tidsskr. for Planteavl*, xxxv, 2, pp. 141–268, 1929. [English summary.]

Only a few of the more important points can be selected for notice from this exhaustive survey of the writer's observations and experiments, extending over a lengthy period, on the incidence and control of the fungous diseases of cereals and grasses in Denmark [*R.A.M.*, viii, p. 95]. The technique of the tests is described and the results tabulated, fully discussed, and compared with those obtained in other countries.

The following are some of the treatments giving satisfactory control of wheat bunt (*Tilletia caries*) in these trials: 30 minutes' immersion in 0·25 per cent. germisan; the semi-dry germisan method (100 gm. in 2 l. of water, or 60 gm. in 3 l., using a mixing drum, per 100 kg. of seed-grain); dusting with 100 to 200 gm. of germisan per 100 kg. of seed-grain; dusting with copper carbonate (200 gm. per 100 kg.), abavit (200 gm.), abavit B (200 to 300 gm.), danatin (100 gm.), 225 (200 gm.), 225 V and 225 III (200 to 300 gm.), 175 and 175 V (200 gm.), porzol, porzol 55, D, and H (200 to 300 gm.), semesan (200 gm.), tillantin and tillantin C (100 gm.), and tillantin R (300 gm.); and sprinkling with danatin (25 to 30 or 50 to 60 gm. in 10 to 12 l. of water), N.G. 85 (60 gm. in 12 l.), and semesan (60 gm. in 12 l.).

The incidence of *T. foetens* is stated to be negligible, the fungus having been found only a few times in spring wheat.

Loose smut of wheat (*Ustilago tritici*) is of little economic importance in Denmark now that the cultivation of the susceptible Criewener and Wilhelmina varieties has been discontinued. Of late years, however, numerous attacks on Standard wheat have been reported. The disease may be controlled by the hot water method.

Stem smut of rye (*Urocystis occulta*) is widespread, and disinfection against this disease has hitherto been little practised. Good results were given in the writer's control experiments by dusting with abavit and abavit B (200 gm. per 100 kg.), 225, M.C. III, 175, and 175 V (200 gm.), copper carbonate (200 to 250 gm.), germisan (200 gm.), porzol (200 to 300 gm.), tillantin C (100 gm.), tutan (200 gm.), and other preparations [which are enumerated], as well as by sprinkling with 0·5 per cent. agfa (12 l.), 0·8 to 1 per cent. dan II and 0·5 per cent. dan IV (15 l.), 0·5 per cent. germisan (12 l.), 0·4 per cent. higosan (15 l.) followed by covering for 6 hours, 0·5 per cent. semesan (12 l.) covering for 8 hours, 0·5 per cent. tillantin C (15 l.), 0·5 per cent. uspulun (15 l.), &c.

Covered smut of barley (*Ustilago hordei*) is stated to be steadily decreasing in Denmark in consequence of improved methods of seed-grain disinfection, combined with the practice of early sowing of the spring crop. Loose smut of barley (*U. nuda*), on the other hand, appears to be gaining ground, and should be combated (at any rate in selected seed stocks) by the hot water treatment.

Stripe disease of barley (*Pleospora graminea*) [*Helminthosporium gramineum*] is widespread and severe on the susceptible

Karls, Prentice, and Guld varieties (up to 65 per cent. in the first named). Infection scarcely spreads at all from one field to another, but within individual fields the incidence may increase (in actual cases observed) from 4 to 11 or 14 to 32 per cent. in a year. The disease was well controlled by dusting with abavit 1286 (400 gm. per 100 kg.) and 225 (300 gm.); 1 hour's immersion in 0·1 per cent. germisan or 3 hours in 0·3 per cent. semesan; and sprinkling with 0·5 per cent. germisan (12 l.) followed by covering for 6 to 8 hours, and uspulun-universal (60 to 75 gm. in 10 to 12 l. of water), as well as by various other methods [which are listed].

Net blotch (*P. teres*) [*H. teres*] [ibid., viii, p. 165] may occur in epidemic form on the susceptible Prentice variety in wet seasons accompanied by low soil temperatures (7° to 11° C.). Germisan, tillantin C, and other preparations suitable for the control of stripe disease may also be applied against net blotch.

Loose smut of oats (*U. avenae*) is of fluctuating importance under Danish conditions, having been very severe in 1912–13, 1915–16, and 1918–22, while since 1924 it has caused no appreciable damage. Good results have been obtained by dusting with E.L. 15, germisan, and uspulun (200 gm. per 100 kg.), and 225, tillantin C, and hafer-tillantin (300 gm.).

Covered smut of oats (*U. levis*) [*U. kolleri*] is of minor importance in Denmark.

Brome smut (*U. bromivora*) is very common and often causes heavy losses through seed infection. Sprinkling with 0·5 per cent. germisan, tillantin C, and agfa gave good control.

Smut (*U. perennans*) of oat grass [*Avena elatior*] [ibid., vi, p. 344] is prevalent at times; sprinkling with 0·25 per cent. formalin (60 l., followed by covering for 6 hours) and 0·5 per cent. germisan (80 l.) gave satisfactory control of this disease and also of bacteriosis of cock's foot grass [*Dactylis glomerata*] caused by *Erwinia* [*Bacterium*] *rathayi* [ibid., vii, p. 222].

Seedling fusariosis (*Fusarium minimum* [*Calonectria graminicola*] and other species) has attracted renewed attention of recent years. Foot rot of oats (*F. avenaceum*) and other cereals (chiefly *F. culmorum*) is largely the result of soil infection and therefore not directly amenable to seed-grain treatment. The results of experiments in the control of *C. graminicola* are conflicting. Uspulun (30 minutes' immersion in a 0·25 per cent. solution or sprinkling at the same strength) proved very satisfactory, as also did tutan dust (300 gm. per 100 kg.), and germisan and tillantin C used in various ways.

A twelve-page bibliography is appended.

GENTNER (G.). **Eine Methode zum Nachweis der Sporen des Steinbrandes und anderer Pilzarten am Saatgut.** [A method for the detection of the spores of bunt and other species of fungi on seed-grain.]—*Fortschr. der Landw.*, iv, 11, pp. 353–356, 2 figs., 1929.

In the author's opinion, none of the current methods for the detection of bunt [*Tilletia caries* and *T. foetens*] spores on wheat seed-grain is entirely satisfactory. He has accordingly devised a process [full details of which are given] whereby a reasonably

accurate determination of the number of spores on a given sample of seed-grain may be made in 15 to 20 minutes. The method is essentially as follows: 10 gm. of the sample to be tested is shaken up twice in succession with 15 c.c. of alcohol or methylated spirits and the resulting spore suspension transferred in a specially constructed apparatus [which is described and figured] to a circular filter. After the spirit is filtered off, the spores remain behind on the filter paper, which is rendered transparent by means of xylol or toluol so that the spores may be counted under the microscope.

This method may also be applied to the detection of other dark-coloured seed-borne spores.

Klushnikova (Mme E. S.). Распределение мицелия **Ustilago tritici** в тканях питающего растения и анатомические изменения, вызываемые им в строении растения-хозяина. [Distribution of the mycelium of *Ustilago tritici* in the tissues of the host plant and anatomical changes caused by it in the structure of the host tissues.]—*Morbi Plantarum*, Leningrad, xvii, 1–2, pp. 1–25, 2 pl., 1928. [French summary. Received August, 1929.]

The experiments described in some detail in this paper were made at the Botanical Gardens in Moscow from 1925 to 1927, for the purpose of determining the distribution of the mycelium of loose smut (*Ustilago tritici*) in the tissues of the host from the seedling to the mature stage, and the anatomical changes caused by it. In all three years the author used smut infected seed of the 1924 crop of a pure line of *Triticum vulgare* var. *lutescens*. Preliminary examination of the dormant seed-grain showed that in this stage the mycelium of the fungus not only accumulates in large quantities in the portion of the endosperm adjoining the scutellum, but also penetrates the latter and is present in all the organs of the embryo, chiefly at the growing point. The fact that in 1926 the tissues of the seed were more extensively invaded by the mycelium than in 1925 would indicate that there occurs some development of the mycelium during the dormancy of the seed.

In describing the development of the fungus in the tissues of the host parallel with the growth of the latter, the author states that she established the presence of the mycelium in the roots (but not later than the 14th or 16th day of growth), in the stems, and in the leaves and sheaths of the diseased plants. It was noted, however, that the leaves were always less invaded than the corresponding sheaths, and that the extent of invasion of the leaves was inversely as the height of their insertion on the stem, i. e., was greatest in coleoptyle and lowest in the apical leaves. Some morphological differences [which are described] were also noticed between the mycelium in the internodes and that developing in the nodes.

As regards the histological changes brought about by the parasite in the invaded tissues, it was found that in diseased plants the vascular systems are somewhat hypertrophied and with enlarged intercellular spaces, while the superficial area of the chlorophyll parenchyma is greater than in healthy plants. An increase in the number and size of the stomata in infected leaves was also observed. The palisade cells are shorter, more irregular in height, and less

densely compacted than in non-infected leaves. These alterations lead the author to consider that smut diseased plants exhibit certain xeromorphic features in their structure, corresponding to the changes in their physiological functions noticed by Koursanoff [*R.A.M.*, vii, p. 708].

Lundegårdh (H.) & Burström (H.). **Undersökningar över betningsmedlens verkningar vid olika groningsbetingelser.** [Investigations on the effects of disinfectants under different conditions of germination.]—*Centralanst. för försöksväsendet på jordbruksområdet Meddel.* 349, 24 pp., 9 graphs, 1929.

In a series of experiments [the technique of which is described and the results tabulated and discussed] on the action of various fungicides on cereal seed-grain grown under varying conditions, the writer tested the dusts uspulun-universal, abavit B, B 35 and B 44 (Swedish preparations), and also germisan solution against *Fusarium* spp. on Norrland rye and Extra Kolben II wheat. The seed-grain was sown in (*a*) natural soil, (*b*) sterilized soil, and (*c*) brick dust, each series being tested at temperatures of 10° to 35° C. at 5° intervals.

Sterilized soil proved quite unsuitable for the purposes of the tests, chiefly because it reduced the incidence of infection to a minimum even on the untreated seed-grain. Brick dust proved superior to sterilized soil in respect of uniformity of results, but it has the drawback of a low water-holding capacity which leads to a less satisfactory growth of the seedlings. Its sole advantage over natural soil lies in its capacity to prevent secondary infection, and this end may be equally well accomplished in natural soil (otherwise greatly superior to brick dust) by wide spacing of the seed-grain (20 per 100 sq. cm.). The best results were obtained in soil of relatively high humidity (80 to 100 per cent. of the weight of the air-dry soil) and at a temperature of 10° to 15°.

Foëx [E.] & Rosella. **Sur une forme endoconidienne accompagnant un sclérote constitué dans un épi de Blé.** [On an endoconidial form accompanying a sclerotium formed in an ear of Wheat.]—*Bull. Soc. Myc. de France*, xliv, 4, pp. 349–359, 10 figs., 1929.

In an ear of wheat the authors found a hard sclerotium of a violet-amethyst colour in one of the grains, on the surface of which was a softer mycelial layer surrounded by conidia mostly arranged in rows of two of three in the interior of the terminal portions of the hyphae, like ascospores. The spherical or, more often, oval endoconidia measured 5 to 10 by 2 to 5 μ and the walls of the hypha in which each group was borne frequently disappeared, no doubt by deliquescence. The sclerotium consisted of closely woven filaments; the periphery formed a sort of black cortex composed of two or three layers of dark-walled cells, beneath which was a white pseudoparenchyma, certain cells of which had much thicker walls than those of the rest. At the surface was a looser mycelial covering, with the broad endoconidial hyphae arranged in a row on the surface and a loose pseudoparenchyma below.

Cultures were obtained from pieces of the sclerotium and gave

a white or deep brown mycelial growth, sometimes developing into stromatic masses. Conidia were formed in these cultures, sometimes budded off from the extremities of branched conidiophores and then measuring 10 to 22 by 4·5 to 6·75 μ, sometimes as endoconidia in the interior of the terminal segment of a hypha, the contents of which fragmented into cylindrical elements, 6 to 11 by 3·25 μ in diameter. The endoconidia only developed on solid media and were most numerous in a dense surface pellicle which formed slowly on the top of the mycelial mass.

SCHAFFNIT (E.). **Auftreten der Braunfleckigkeit des Hafers. (Helminthosporium avenae).** [Occurrence of brown spot of Oats (*Helminthosporium avenae*).]—*Deutsche Landw. Presse*, lvi, 24, p. 353, 1929.

Attention is drawn to the unusual prevalence during the current season, in central and western Germany, of brown leaf spot of oats (*Helminthosporium avenae*) [*R.A.M.*, vi, pp. 146, 713]. The leaves become covered with spots which are at first dark brown and striate but later become reddish-brown and have wide margins. Young plants (up to the formation of the third leaf) are often killed out by the disease, leaving gaps in the stand. The disease is thought to be disseminated mainly by wind-borne spores from the earlier infections rather than through the seed, since it only occurs in patches (50 to 100 sq. m. in area) in otherwise healthy stands.

IRRGANG. **Braunfleckigkeit des Hafers.** [Brown spot of Oats.] —*Deutsche Landw. Presse*, lvi, 29, p. 418, 1929.

In connexion with the widespread occurrence, during the current season, of brown spot of oats [*Helminthosporium avenae*: see preceding abstract], the author states that a strip of one of his oat fields strewn with Chile saltpetre (12·5 kg. per hect.) remained completely free from the disease, which attacked the remainder of the crop. The affected oats were preceded by potatoes, and an adjacent crop similarly attacked was grown in succession to peas. All the seed-grain was treated with abavit. The disease appears to spread from plant to plant, as the small patches first observed rapidly increased in size.

SCHLÜTER. **Braunfleckigkeit des Hafers.** [Brown spot of Oats.] —*Illus. Landw. Zeit.*, xlix, 29, pp. 336–337, 1929.

Brown spot of oats (*Helminthosporium avenae*) [see preceding abstracts] occurred in a severe form on the writer's estate in Pomerania, causing a reduction of some 50 per cent. in the yield of the affected stands. The patches of disease were of varying size and irregular shape, and the diseased plants were stunted, with light to rusty-brown stripes and spots on the leaves. Infection spread rapidly from plant to plant, evidently favoured by the dry weather, and eventually the patches reached a size in some places of up to 200 sq. m. All the affected stands were grown on soil receiving a spring dressing of 25 lb. nitrogen per $\frac{1}{4}$ hect., and the seed was treated with germisan. The affected varieties were Strube's White and Streckenthiner No. 9, but there was no

obvious effect on the disease from differences in the varieties grown, date of sowing, type of soil or cultivation, or manurial treatment.

HANNA (W. F.). **Studies in the physiology and cytology of Ustilago zeae and Sorosporium reilianum.**—*Phytopath.*, xix, 5, pp. 415–441, 1 pl., 2 figs., 1 diag., 1929.

This is a more extensive account of the writer's studies in the physiology and cytology of *Ustilago zeae* and *Sorosporium reilianum* than that already noticed [*R.A.M.*, viii, pp. 375, 376].

In both these species the nuclei of the promycelial cells divide at the time of sporidial formation, leaving a daughter nucleus in each promycelial cell. Thus, by a repetition of the process, several generations of sporidia may be produced from a single promycelial cell. The primary sporidia of both species are uninucleate, as are also the secondary sporidia of *U. zeae* produced by budding in culture, whereas those of *S. reilianum* are occasionally bi- or multinucleate. Some promycelia of *U. zeae* may bear two sporidia of one sex and two of the opposite sex, the former being arranged in pairs on the promycelium or alternating with those of the latter. The promycelium of one smut spore may also produce sporidia belonging to four sexual groups. When four monosporidial cultures from an Italian smut spore were paired with those from a Minnesota spore, the same two sexual groups were found to be present in both sets of cultures.

The haploid mycelium of *U. zeae* is composed of fine hyphae and is only weakly parasitic, never producing galls, whereas the diploid mycelium arising in the host plant through the conjugation of two haploid hyphae of opposite sexes is actively parasitic and gives rise to sori. In *S. reilianum* also the diploid mycelium alone produces sori. When fragments of maize leaves infected by the diploid mycelium of *U. zeae* are floated on distilled water in a Petri dish, hyphae grow out through the epidermis and produce chains of apparently haploid sporidia. Possibly this process also occurs in nature under damp conditions, the resulting sporidia being carried by the wind to other plants and causing fresh infections.

Greenhouse plants inoculated with certain combinations of sporidia of *S. reilianum* developed sori on the leaves, whereas field infections were observed to be confined to the inflorescence.

Sporidia belonging to four sexual groups were produced from a single spore of *S. reilianum*, monosporidial cultures of which also developed mutants.

KYLE (C. H.). **Relation of husk covering to smut of Corn ears.** —*U.S. Dept. of Agric. Tech. Bull.* 120, 2 pl., 1929.

Seven self-fertilized lines of maize, two from the Garrick variety, two from Boone County White, and three from Cuban Yellow, with established differences in husk (ear sheath) protection, were represented in the experiments here reported by 21 F_1 crosses from all possible combinations. It seems probable that intermediate inheritance of the husk complex between the varieties with a large number of ears completely enclosed in the husks and those with more or less wide openings in the latter, in combination with

variable ear size, gave the resulting husk protection in the different crosses. All the ears tightly enclosed by husks were free from smut (*Ustilago zeae*). The crosses involving line G (one of the Cuban Yellows) were the best husk-protected group and produced only about one-eighth as many smutted ears as those of line C (Garrick), which were poorest in husk protection as the husks tended to be too short to enclose the tip of the ear. The relative sizes of husks and ears varied to some extent with environment, but this effect was slight in crosses having the greatest average proportion of size of husks to size of ears.

HASKELL (R. J.) & DIEHL (W. W.). **False smut of Maize, Ustilaginoidea.**—*Phytopath.*, xix, 6, pp. 589–592, 1 pl., 1 fig., 1929.

In 1925 the writers examined some maize tassels from Louisiana bearing excrescences which superficially resembled those of *Ustilago zeae* but on closer inspection were found to be the sclerotia of an *Ustilaginoidea*, and in 1926 similar material was received from the Panama Canal Zone [*R.A.M.*, vii, p. 75]. The surface of a mature sclerotium is much roughened, olive-green to nearly black, and of a velvety appearance, while the interior is white. The extreme outer layer is composed of a mass of mature spherical to ovate spores, 4 to 7 (usually 6) μ in diameter, borne on short, sterigma-like projections from the walls of septate, yellowish-green hyphae, 2 to 3 μ in diameter. The fungus is tentatively referred to *U. virens*, the causal organism of false smut of rice [ibid., v, p. 158], and is considered to be of little economic importance.

HIURA (M.). **Studies on some downy mildews of agricultural plants. I. On Sclerospora graminicola (Sacc.) Schroet., the causal fungus of the downy mildew of Italian Millet (the second preliminary note).**—*Journ. Soc. Agric. Sci. Japan, 1929*, 319, pp. 245–253, 1929. [Japanese, with English summary.]

Continuing his studies on the causal organism of downy mildew (*Sclerospora graminicola*) of Italian millet [*Setaria italica*: *R.A.M.*, viii, p. 441] in Japan, the author ascertained that in the field the conidia of the fungus are apparently produced during the night, and not in the daytime [ibid., iii, p. 718]. In the laboratory, however, abundant conidial production occurs on diseased leaves during the day, provided external conditions favour the development of the fungus [cf. ibid., vii, p. 712, the last paragraph of which refers to *S. graminicola*, not to *S. macrospora* as erroneously printed]. The optimum temperature for conidial production was found to lie between 17° and 21° C. in a completely saturated atmosphere. The conidia are projected from the sterigmata to an average distance of somewhat less than 2 mm. (maximum about 3 mm.).

HIURA (M.). **Studies on some downy mildews of agricultural plants. I. On Sclerospora graminicola (Sacc.) Schroet., the causal fungus of the downy mildew of Italian Millet (the third preliminary note).**—*Agric. and Hort.*, iv, 5, pp. 525–534, 1929. [Japanese, with English summary.]

Inoculation experiments with the causal organism of downy

mildew (*Sclerospora graminicola*) of Italian millet [*Setaria italica*: see preceding abstract] showed that the oospores are the primary source of infection. Near Gifu favourable meteorological conditions for primary infection occur at the beginning of June and October. This infection occurs when the shoots are still underground. Field and laboratory observations indicate that secondary infection by zoospores is of rather rare occurrence. The oospores germinate by means of unseptate, hyaline, branched germ-tubes, usually 6 to 8 μ in width.

HAAS (A. R. C.). **Mottle leaf in Citrus artificially produced by lithium.**—*Bot. Gaz.*, lxxxvii, 5, pp. 630–641, 4 figs., 1929.

The author and his collaborators have recently shown that the absorption of a toxic agent in sufficient concentration may be an important factor in the causation of such diseases as yellows or little leaf of walnut trees [*R.A.M.*, viii, p. 207]. In the present paper particulars are given of experiments on the effects of lithium in the artificial production of mottle leaf of citrus.

The lithium was applied [by methods which are fully described] to Valencia orange and Eureka lemon-trees in sand cultures and to Valencia and Smith's Early Navel oranges in Sierra loam soil cultures. In both cases the typical symptoms of mottle leaf (wrinkling, pale yellowish-green mottling, desiccation, and abscission) were induced. A concentration of 1 part per million was sufficient to produce the symptoms in lemon trees, but the oranges withstood doses up to 3 p.p.m. in the culture solution. On ceasing to apply lithium in the solution the new growth gradually became normal. Presumably the lithium acts as a poison to the growth processes taking place within the leaves, so that the latter are unable fully to utilize the inorganic salts in the tracheal sap, and consequently retain the composition of immature normal leaves.

Analyses of the sap of comparable portions of mottled and normal Valencia and Washington Navel orange trees in the field showed that, although calcium may be deficient in the leaves of diseased trees, the tracheal sap may contain large concentrations of this element, possibly because of the inability of the mottled leaves to utilize it.

SELLSCHOP (J. P. F.). **A mutation in Gloeosporium.**—*Phytopath.*, xix, 6, p. 605, 1 fig., 1929.

A brief note is given on a sudden mutation in a Petri dish culture of a *Gloeosporium* isolated from a lemon at Illinois University. A segment of the culture presented a light appearance, due to the presence of only a few scattered orange and black acervuli instead of the usual dark masses. Subsequent transfers made from the dark and light segments remained constant, so that the mutation was apparently of a permanent order.

FAWCETT (H. S.). **Nematospora on Pomegranates, Citrus, and Cotton in California.**—*Phytopath.*, xix, 5, pp. 479–482, 1 fig., 1929.

In September, 1928, a species of *Nematospora* (probably *N. coryli*) [*R.A.M.*, v, p. 390] was found on pomegranates and citrus in Imperial County, California, and later on cotton bolls in the

same region. The western leaf-footed plant bug (*Leptoglossus zonatus*) was found to be carrying the fungus from pomegranate (apparently a new host) to citrus. This seems to be the first record of *N. coryli* on the three above-mentioned hosts in the United States.

In general, the fungus causes a staining and collapse of the tissue, ultimately resulting in desiccation frequently accompanied by dry rot. Pomegranates first show pale, depressed spots in the fleshy covering surrounding the seeds. Later these develop into a general brown discoloration and collapse of certain regions of the pulp, involving the fleshy part of many adjacent seeds. Oranges, grapefruit, and tangerines show a brownish to reddish-brown discoloration of the juice sacs, which is eventually followed by their collapse. Young affected cotton bolls exhibited a discoloration of the seeds and desiccation of the inside portions; the immature lint was yellowish at first and later dark reddish-brown and dry for varying distances from the original insect punctures.

The disease was readily transmitted by placing *L. zonatus* from infected pomegranates on sound oranges and lemons in jars in the laboratory, the symptoms developing in the inside of the fruit in two to three weeks. Attempts to isolate the fungus from the beaks of the insects failed, but it was readily isolated on glucose-potato agar and cornmeal agar by transferring juice sacs from infected citrus fruits to the surface of slants. On the former medium the fungus produced irregular, somewhat rugose colonies, while on the latter growth was much slower, with a considerable margin of superficial mycelial development. Successful needle puncture inoculations were made into immature navel oranges. On glucose-potato agar very good growth was made at temperatures from 15° to 32° C., the maximum amount occurring at 25·5° to 27·5°. The length of the asci varied considerably at different temperatures, averaging 72 to 80 μ at 21·5°, 80 to 93 μ at 24°, 88 to 102 μ at 25·5°, and 104 to 106 μ at 27·5°; the width ranged from 8 to 12 μ irrespective of temperature. The approximate dimensions of the ascospores were 40 by 2·5 μ.

[A condensed popular version of this paper is contained in the *California Citrograph*, xiv, 4, p. 124, 1929.]

YOUNG (V. H.), WARE (J. O.), & JANSSEN (G.). **II. Preliminary studies on wilt resistance and on the effect of certain soil factors on the development of Cotton wilt.**—*Arkansas Agric. Exper. Stat. Bull.* 234, 32 pp., 7 figs., 2 diags., 1929.

The results [which are discussed and tabulated] of experiments conducted during 1926–7 in two localities of Arkansas have shown that the wilt (*Fusarium vasinfectum*) -resistant varieties of cotton, e. g., Cook, Dixie Triumph, and Super Seven, gave very satisfactory yields even where root knot (*Caconema* [*Heterodera*] *radicicola*) was a complicating factor [*R.A.M.*, viii, p. 101]. Certain staple varieties, such as Super Seven, Lightning Express No. 6, and D. & P.L. No. 6, appear to be well adapted for cultivation on bottom land areas in Arkansas. Miller, Rowden 40, and D. & P.L. No. 4 should be grown where wilt is a limiting factor. Among the

shorter cottons included in these tests, Cleveland 54, Dixie Triumph, and Cook's Improved gave the most promising results.

Organic fertilizers applied in the form of green manure (*Crotalaria*, vetch [*Vicia* spp.], and red clover [*Trifolium pratense*]) failed to reduce the incidence of cotton wilt in controlled pot experiments in the greenhouse. Available data show that nitrite production in green-manured soils may be greater than in those treated with an inorganic nitrate fertilizer, even when both are inoculated with *F. vasinfectum*. Ammonia and nitrate determinations of soil treated with organic and inorganic nitrogen showed no correlation with the percentages of wilt secured. The strain of the cotton wilt fungus used in these tests did not act as a reducing organism when grown in a solution using inorganic salts as a source of nitrogen.

[In the analysis of the previous paper on this subject by the senior author in this *Review*, viii, pp. 101–2, the statement in the last paragraph that Cook, Dixie Triumph, and Super Seven germinate and grow better in cool soil was based on a misreading of the author's meaning. No varieties appear to be known as yet to possess this property.]

GOLDSTEIN (BESSIE). **A cytological study of the fungus Massospora cicadina, parasitic on the 17-year cicada, Magicicada septemdecim.**—*Amer. Journ. of Botany*, xvi, 6, pp. 394–401, 3 pl., 2 figs., 1929.

In June, 1928, the periodical cicada, *Magicicada septemdecim*, was found to be commonly infected by *Massospora cicadina* [*R.A.M.*, i, p. 65] in New Jersey and Staten Island, New York, the damage being particularly severe in the latter locality.

Insects attacked by the fungus present a striking appearance. As each successive segment of the body becomes filled with the spores, the chitinous band around the segment is ruptured by the pressure of the swelling mass of hyphae and breaks away, exposing a creamy-white mass of spores which soon becomes dry and brittle. This may crumble or break away in a single piece. Ultimately the insect is left flying about with only a head and thorax. The clay-coloured mass protruding from the posterior end of the body is composed of clusters of binucleate spores with heavy, warted walls lying within chambers, the thin walls of which are formed from collapsed hyphae and conidiophores. A cytological examination of living and dead material showed that the segment of the insect next in front of the one containing ripened conidia presents a honeycombed appearance, the cavities being empty and the walls consisting of a hymenium-like palisade of short, stout, binucleate conidiophores, each bearing a single bud which eventually receives the entire contents of the conidiophore and becomes a conidium. The hyphal cell below the conidiophore is emptied of its contents, shrinks, and is finally crushed as other turgid hyphae converge towards the common centre or form new ones.

Within the segment in which the chambers are being formed, and possibly in one or more anterior to this region, lie masses of so-called hyphal bodies, thin-walled, oval or rounded, and binucleate. From these bodies arise the long hyphal branches out of which

the chambers are formed by intertwining and the subsequent separation of a cavity lined by conidiophores. In some specimens the writer detected the remains of the original mycelium which penetrated the body organs, and whose hyphae are branching and contain large nuclei, but are rarely septate. Later they become more frequently septate, forming cells with two or rarely three nuclei. The hyphal bodies are formed by the separation and subsequent rounding up of these cells.

Masses of resting spores were found in cicadas collected on 7th July. Each resting spore is produced by budding from a tetranucleate hyphal body considerably larger than those forming the conidial mycelium. The resting spores, which often contain four nuclei, are readily distinguishable from the conidia and hyphal bodies by their larger size and heavier walls, sculptured with deep reticulations.

There can be no question that this fungus is one of the Entomophthoraceae. Cytologically it possesses the same type of heavy, septate mycelium with large, conspicuous nuclei as that occurring in *Empusa muscae* in house flies and species of *Drosophila* [ibid., vi, p. 725], in *Lamia culicis* in gnats, and in *Entomophthora americana* in flower flies.

ATKINS (D.). **On a fungus allied to the Saprolegniaceae found in the pea-crab Pinnotheres.**—*Journ. Marine Biol. Assoc.*, N.S., xvi, 1, pp. 203–219, 13 figs., 1929.

Full particulars are given of a fungus, having the general characters of the Saprolegniaceae, which has recently been found in pea-crabs (*Pinnotheres*) taken from mussels (*Mytilus edulis*) from the estuaries of the Camel and Yealm, and from near the junction of the Tamar and Tavy (Cornwall).

The presence of the fungus is generally indicated some days before the death of the crab either by opaque white patches showing through the chitin of its body, or more rarely by opacity of the gills. A white line is sometimes seen along the junction of the carapace with the abdomen, and patches may also occur in the latter. These white patches probably surround the original point of infection, so that the fungus evidently enters the crab either where the chitin is extremely thin or along the fine chitinous membrane uniting the abdominal segments, and joining the posterior border of the carapace to the abdomen. The patches are constituted by an intricately branched, felt-like mycelium of fine unseptate hyphae about 9 μ wide; occasionally very broad, uncrowded hyphae, up to about 32 μ wide, are found in the roof of the gill chamber. Apparently the fungus spreads for some distance in the tissue between the gill chamber and the thicker chitin of the dorsal surface of the carapace, while branches are sent into the gills and sometimes the mouth parts, but no mycelium was ever observed on the exterior of the crab, even after the death of the latter. Once the organism enters the gills the tissue is quickly absorbed and death soon follows, possibly as the result of asphyxiation. The whole of the hyphal contents in the gills gradually divide into small and large zoospores, the former measuring about 8 μ in length and the latter 14 μ. The sporangia are formed from broad, un-

changed, often branched hyphae, cut off by a septum from the rest of the mycelium, as in *Aphanomyces* and *Leptolegnia*. The spore-bearing filaments are apparently confined to the gills and pleopods; they are strikingly regular in outline and vary in width from 10 to 20 μ. The zoospores are crowded irregularly in the sporangium and are liberated to the exterior through short branches or papillae (generally measuring 0·03 to 0·12 mm. in length) developed at the tip or laterally. After discharge, a new sporangium may occasionally grow up within the old one. Discharge is rapid at first and then slows down, and the zoospores swim away directly they are liberated. The zoospores may remain active for 50 minutes and eventually form cysts, which range from 6 to 10 or 11 μ in diameter. After encystment a second motile phase may perhaps occur, though the evidence for this was not decisive. The shape of the zoospores on liberation is irregular to pear-shaped, and they swim with the narrow end foremost. The position of insertion of the two cilia was not definitely determined, though one is clearly apically attached. Sexual organs were not definitely identified, though there is a possibility that some round bodies containing many black globules may be oogonia or gemmae.

The disease has been shown to spread rapidly from one crab to another and infected individuals always die. However, there is not yet sufficient evidence to determine whether the fungus is pathogenic or only invades tissue already injured by parasitic bacteria. The *Pinnotheres* fungus [which is not named], though most probably allied to the Saprolegniaceae, differs from all members of the family hitherto described in its occurrence wholly within the body of a marine invertebrate.

BOISSEAU & MESNIL. **Rôle de la Monilia dans la fermentation du Pont-l'Evêque.** [Rôle of *Monilia* in the fermentation of Pont-l'Evêque.]—*Comptes rendus Acad. d'Agric. de France*, xv, 14, pp. 580–583, 1929.

An important, if not indispensable part in the manufacture of Pont-l'Evêque (formerly known as Augelot) cheese is played by *Monilia candida* [*Candida vulgaris*: *R.A.M.*, iii, p. 556], which begins to develop four or five days after the coagulated milk is transferred to the moulds. The fungus promotes the ammoniacal transformation of the casein and thus occupies a similar position to that of *Penicillium* in the preparation of cheeses of soft consistency [cf. ibid., vii, p. 542]. The development of the *Monilia* is favoured by sufficient acidity of the coagulated milk (22° to 23° Dornic) and a fairly high temperature in the preparation room (18° to 20° C. day and night). A feeble growth of the fungus is readily destroyed by *Oidium* [*Oospora*] *lactis*, which liquefies the cheese and renders it unsaleable.

WEIDMAN (F. D.). **The place of fungi in modern medicine.**—*Amer. Journ. Med. Sci.*, clxxvii, 6, pp. 832–843, 1929.

This is a general discussion on the rôle of fungi in the etiology of a number of diseases of the respiratory and digestive tracts, the eyes, ears, skin, bones, &c., with some observations on recent developments in the cure of such conditions by intravenous and

other methods of therapy. Closer co-operation between clinical workers and mycologists is strongly urged.

Balog (P.) & Grossi (G.). **Allergie der Haut bei Lungenmoniliasis.** [Allergy of the skin in moniliasis of the lungs.]—*Arch. für Dermatol.*, clvii, 3, pp. 549–554, 1929.

The writers describe the technique and results of the process of subcutaneous injection with an autovaccine of *Monilia* [? *Candida*] *pinoyi* [*R.A.M.*, vii, p. 640] as a remedy against moniliasis of the lungs. The outcome of the treatment, applied to the authors' patients in Cairo, was extremely satisfactory.

Wilenczyk (A.). **Sur la formation d'asques chez l'Epidermophyton.** [On the formation of asci in *Epidermophyton.*]—*Comptes rendus Soc. de Biol.*, ci, 21, pp. 593–594, 1 fig., 1929.

An apparently new species of *Epidermophyton*, characterized by the slow development of yellow (later dark green) colonies and ultimately by the formation of pluriseptate spindles, was found to produce spherical or elongated asci, closely resembling those of *Trichophyton* and *Achorion schoenleini* when cultivated on Sabouraud's medium at 37° C. for three to four weeks and subsequently transferred to ordinary temperature [*R.A.M.*, viii, p. 576].

Stevenson (J.). **Ringworm of the hands and feet.**—*Journ. Oklahoma State Med. Soc.*, xxii, pp. 113–115, 1929. [Abs. in *Internat. Med. Digest*, xiv, 6, pp. 332–334, 1929.]

Attention is drawn to the prevalence of epidermophytosis of the hands and feet [*R.A.M.*, viii, p. 645] among members of Oklahoma country clubs, where the condition is popularly known as 'golfer's itch'. Infection is commonly contracted from the floors of shower baths, and also from wool and leather. The fungi concerned in the etiology of this type of ringworm appear to be quite resistant to the ordinary processes of laundering. Brief notes are given on the clinical and therapeutical aspects of the disease.

Catanei (A.). **Reproduction de différents types de lésions sporotrichosiques chez l'animal, avec un Sporotrichum trouvé dans la nature.** [Reproduction of different types of sporotrichotic lesions in animals, with a *Sporotrichum* occurring in nature.]—*Comptes rendus Soc. de Biol.*, ci, 20, pp. 447–448, 1929.

Various types of abscess, ulceration, and other forms of sporotrichosis occurring in man were produced in laboratory animals at the Institut Pasteur d'Algérie, by inoculation with 5- to 10-day old cultures on Sabouraud's medium of a species of *Sporotrichum* (? *S. biparasiticum* Bubák) isolated from well water.

Strelin (S. L.). Прикорневая гниль Ворсянки (**Sclerotium varium Pers. на Dipsacus fullonum Mill.**). [A crown rot of the Fullers' Teasel (*Sclerotium varium* Pers. on *Dipsacus fullonum* Mill.).]—*Materials for Mycol. and Phytopath.*, Leningrad, vii, 1, pp. 182–184, 1928. [Received August, 1929.]

A brief description is given of a crown rot which is threatening

the newly introduced culture on the southern coast of the Crimea of the fullers' teasel (*Dipsacus fullonum*), a crop which is stated to be of considerable economic importance under the present conditions of the woollen industry in Russia. The disease appears to be caused by three organisms, which usually follow each other in a definite sequence. The first to appear are sclerotia which occur in large numbers in the interior (frequently also on the exterior, in the axils of dead basal leaves) of the attacked main stems of the plant, which then bend over and even break off at the collar. These sclerotia were identified as those of *Sclerotium varium*; they are irregularly shaped bodies, measuring from 6 to 7 mm. in length, 4 to 4·5 mm. in width, and 2 to 3 mm. thick. This condition is followed by a well-defined rot caused by a *Botrytis* of the *cinerea* type, the mycelium of which extends upwards and downwards from the collar and apparently kills the living cells of the roots. As far as the author is aware, this is the first record of *D. fullonum* as a host for a fungus of this type. Most of the plants in this stage of disease wilt within a few days and are finally killed. Later, after the removal of the teasel-bearing stems, the surviving plants usually bear on their surface small, black, flat, square sclerotia, strongly resembling those of *S. durum*.

The main lines of control recommended are adequate crop rotation and the careful avoidance of all injury to the roots in transplanting the seedlings in the field.

VOGLINO (P.). **L'avvizimento fogliare della Margherita bianca.** [The leaf wilt of the white Marguerite.]—*La Difesa delle Piante*, vi, 3, pp. 1–4, 2 figs., 1929.

In February, 1928, and April, 1929, a severe wilting of *Chrysanthemum frutescens* growing in pots in a glasshouse at Turin was caused by *Ramularia bellunensis* Speg. The leaves turned brown from the tip to the base along the main veins, curled up, and rapidly withered. On the branches and stem elliptical, brown, sparse, slightly sunken areas, surrounded by a thin, darker line, formed parallel to the axis. These coalesced on the stem into long, dark lesions. The young leaves and the unopened inflorescence were attacked first.

In the leaf tissues hyaline, branched hyphae, 4 to 5 μ in diameter, are found, which condense into a thick, dark stromatic layer below the stomata, from which emerge clusters of conidiophores measuring 40 to 120 by 4 to 5 μ and bearing continuous to biseptate conidia, arranged singly or in chains of 3 or 4, and measuring 28 to 37 by 5 to 7 μ. On the dry leaves the conidiophores emerge not only through the stomata but also by penetrating the epidermal cells. On the stalks the subepidermal mycelium forms cords of parallel hyphae, 3 to 4 μ in diameter and bearing lateral branches, which penetrate deeply into the parenchyma, killing the cells. In places the hyphae formed dark stromata which functioned as sclerotia, germinating even after eight months in damp, warm conditions, and forming new hyphae which attacked healthy leaves of *C. frutescens* and produced conidiophores and conidia.

On a dying stem the author also noted the pycnidia with spores of a species of *Phoma*; the former measured 180 to 210 μ in

diameter and the latter were 5 by 3 μ. This may possibly be a pycnidial form of the parasite.

Artificial infections of *C. frutescens* showed that conidiophores bearing mature conidia appear on the under surface of affected leaves even before they become discoloured. Infection of the young stalk causes a wilt of the whole leaf cluster above the lesions, and of the growing inflorescence. Artificial infection of the leaves of *C. parthenium* was also obtained, thus confirming Spegazzini's observation of a wilt of this host caused by the same fungus.

The conidia germinate in water at 10° to 14° C. in a few hours and in nutrient media short conidiophores and conidia are produced in 60 hours. After six days hyphal clusters formed, resembling the sclerotial-like stromata seen on the stalks.

Normally the hyphae enter through the stomata, but when numerous germinating conidia are present on the leaf the epidermal cells may also be penetrated by the germ-tubes. Mycelial growth is most marked in the spongy parenchyma, but the hyphae can penetrate the palisade tissue directly from the epidermis.

As the conidia soon lose their power to germinate it is considered that the fungus is propagated in the field by means of the sclerotium-like stromata.

The injury caused by this fungus to *C. frutescens* is very severe. Control may be effected by spraying with 1 per cent. Bordeaux mixture or copper oxychloride.

TENG (S. C.). **Rhizoctoniosis of Lobelia.**—*Phytopath.*, xix, 6, pp. 585–588, 1 pl., 1929.

Double blue lobelia (*Lobelia erinus*) at Cornell University was severely attacked in 1927 by a strain of *Rhizoctonia* causing hydrolysis and yellowing of the lower leaves and the formation of necrotic lesions at the stem bases, followed by rotting of the affected organs. The plants were often covered with the mycelium of the fungus, giving them a thread-blight appearance. Sometimes numerous aerial roots formed just above the lesions at the stem bases, and after the death of the tops, new shoots developed from the crowns. In some cases the plants were stunted, with abnormally dark green foliage.

The causal organism grew best on Czapek's agar at 27° C. The perfect stage, which appeared as an ashen-grey mycelium bearing basidia and basidiospores on a partially yellowed leaf near the base of one of the diseased plants, agreed with *Corticum vagum* [*C. solani*].

Inoculations showed that the *Lobelia* strain was pathogenic on various known hosts of *C. solani*. *L. erinus* var. *gracilis* was resistant to infection, but *L. erinus* var. *speciosa* and *L. ramosa* succumbed when the roots were wounded and the plants kept under excessively damp conditions, while *L. cardinalis* showed marked stunting.

Good control of the disease was obtained by the application of $\frac{3}{10}$ of a gram of mercuric chloride in 1 l. of water per $1\frac{1}{2}$ sq. ft. of soil.

KOTTE (W.). **Der Pflanzenschutz im holländischen Blumenzwiebelbau.** [Plant protection in Dutch flower bulb cultivation.] —*Blumen- und Pflanzenbau*, xliv, 6, pp. 97–99, 3 figs., 1929.

A popular account is given of the measures adopted against plant diseases in the Dutch bulb-growing areas, with special reference to the control of *Sclerotium tuliparum* on tulips [*R.A.M.*, viii, pp. 40, 382] by means of steam sterilization of the soil.

MARTIN (G. H.). **Notes on Kabatiella microsticta found on Lily, Iris, and Lily of the Valley.**—*Plant Disease Reporter*, xiii, 3, pp. 43–44, 1929. [Mimeographed.]

Lilium candidum, *L. longiflorum*, *L. regale*, and other species of *Lilium* were recently severely attacked in New Jersey, New York, Maryland, District of Columbia, Florida, and Texas by *Kabatiella microsticta*. In New Jersey, at the New York Botanical Garden, and in the District of Columbia, the same fungus caused a serious blight and leaf spot of *Iris germanica*, accompanied in advanced cases by a scorched, water soaked, slightly purplish appearance. *K. microsticta* was also isolated from lilies of the valley [*Convallaria majalis*] at the New York Botanical Garden and in the District of Columbia. This is believed to be the first record of the fungus on iris, as well as the first report for the United States on lily of the valley.

HALL (A. D.). **The breaking of Tulip species.**—*Gard. Chron.*, lxxxv, 2215, p. 423, 1929.

Evidence has recently been obtained in contradiction of the general supposition that 'breaking' [*R.A.M.*, viii, p. 384] is confined to garden tulips, and does not occur among the true species. Miss Cayley grafted broken bulbs on normal bulbs of *Tulipa eichleri* and *T. greigii*. Most of the bulbs of *T. eichleri* thus forced into contact with a broken variety broke during the current season, as did also two of *T. greigii*. The foliage of the affected plants showed the characteristic mottling of dark and paler green, the size of the flowers and of the entire plants was reduced, and there was some tendency towards the development of torn and laciniated petal edges.

Specimens of *T. kaufmanniana*, *T. clusiana*, *T. tubergeniana*, *T. orphanidea*, and *T. batalinii* at the John Innes Horticultural Institution were found to have broken spontaneously in 1929. In all cases the foliage showed the typical mottling; usually the colour change in the perianth segments was a flecking with a darker colour, but in *T. clusiana* there were white streaks in the crimson on the backs of the outer segments, similar to the ordinary form of breaking in garden varieties. The agent responsible for the transmission of the presumed virus of breaking has not yet been definitely ascertained.

It is evident from these observations that breaking is common to the entire tulip genus and not restricted to the garden forms.

Valleau (W. D.) & Fergus (E. N.). **Black-stem disease of Alfalfa, Sweet Clover, and Red Clover.**—*Phytopath.*, xix, 5, pp. 507–508, 1929.

For the past seven years the writers have made observations in Kentucky on an unfamiliar disease of lucerne, sweet clover [*Melilotus alba*], and red clover [*Trifolium pratense*], which causes blackening of large areas of the stem. The smooth, black lesions are specially conspicuous on sweet clover. On lucerne the disease is probably often confused with bacterial wilt [*Aplanobacter insidiosum*: *R.A.M.*, viii, p. 313], but the Kentucky disturbance is thought to be more likely of fungal origin, though the cause is not yet definitely known.

Black stem may cause serious damage under conditions favouring its development, such as the mild, late autumn of 1927. In the following spring many lucerne plants in fields over two years old were killed; on examination the crowns were found to be dead or dying, though the roots immediately below were healthy and well filled with starch. The injured shoots were either killed back completely or only the tips suffered, in which case lateral growth developed.

In the spring of 1927 the first-crop shoots of some French red clover strains in the test plots at Lexington were practically destroyed by black stem, which probably plays a considerable part in the condition known as clover failure [ibid., vi, p. 558]. There is no direct evidence that black stem is concerned in winter killing of red clover, but it is significant that the extent of this injury during two winters has been directly proportional to the damage caused to the first growth in the spring of 1927.

The disease develops during the spring or early summer, affecting the first cutting of lucerne, but it largely disappears for the remainder of the season. On sweet clover black stem is not likely to be important except in regions where the spring is long and damp.

Miller (P. A.). **A disease of Lippia caused by Sclerotium rolfsii Sacc.**—*Phytopath.*, xix, 5, pp. 509–510, 1 fig., 1929.

Lippia canescens, a widely spreading, herbaceous perennial belonging to the Verbenaceae and extensively used as a turf or lawn plant in southern California, was attacked in 1927 by *Sclerotium rolfsii* [a brief description of which is given]. The fungus killed the tender, green parts of the plants, causing the formation of conspicuous greyish-white, dead areas on the lawn of the Cotton Field Station at Shafter. The affected plants resumed growth during the winter and spring, when the fungus was in the resting stage, but the latter produced fresh infected areas in the summer of 1928. The pathogenicity of *S. rolfsii* was established by the successful inoculation of healthy plants in the greenhouse.

Haskell (R. J.). **Diseases of fruit and nut crops in the United States in 1928.**—*Plant Disease Reporter*, *Supplement* 70, pp. 177–258, 2 diags., 1929. [Mimeographed.]

This report, prepared on the usual lines [*R.A.M.*, vii, p. 727],

contains a number of interesting items, of which the following may be mentioned. Notes are given on the reaction of several commonly grown apple varieties to scab (*Venturia inaequalis*) and blotch (*Phyllosticta solitaria*). The former disease was unusually prevalent and destructive in the north-eastern section and the Great Lakes Region, and the latter in Illinois, Indiana, and Iowa. The geographical distribution of the three apple rusts, *Gymnosporangium germinale*, *G. globosum*, and *G. juniperi-virginianae* [ibid., viii, p. 582] is shown by means of a diagrammatic map. Fruit spot of apple (*Phoma pomi*) appears to be on the increase, on account either of weather conditions favouring infection or of reduced spraying late in the season owing to the risk of arsenic residues, while other obscure factors may also be involved. In New Jersey the disease was well controlled by spraying with 2–6–50 (hydrated lime) Bordeaux mixture [ibid., vii, p. 452]. *P. pomi* also caused heavy damage on quinces in parts of New York State.

Bacterial spot of peaches (*Bacterium pruni*) [ibid., viii, p. 112] also appears to be increasing in prevalence, and was probably more serious in 1928 than ever before. In Illinois the infection of fruit was more general than in previous years, but the leaves, though severely attacked, dropped much less prematurely than usual. In addition to the widely cultivated Elberta variety, on which bacterial spot was most commonly reported, Carman, Hale, and Early Rose were found to be highly susceptible in Georgia. Good results in the control of this disease were obtained by Roberts and Pierce in southern Indiana during 1928 by six applications, at fortnightly intervals beginning at petal fall, of 4 lb. zinc sulphate, 3 or 4 lb. of hydrated lime, and ½ lb. casein or 1½ lb. alum in 50 galls. of water (*Phytopath.*, xix, p. 28, 1929). The leaves of the treated trees showed less spotting and a slighter tendency to defoliation than those treated with sulphur fungicides, besides being larger and of a deeper green colour.

Marshall strawberries on newly cleared land in three localities in Oregon were attacked by *Armillaria mellea* [ibid., vii, p. 650], which was also reported from Washington on the same host.

The Florida avocado crop suffered from anthracnose, caused by *Colletotrichum gloeosporioides* or a closely allied organism [ibid., vi, p. 288].

Figs were slightly infected by anthracnose (*C. elasticae*) in Mississippi and Texas, and in the latter State also by leaf spot (*Cercospora ? fici*).

A species of *Gloeosporium* resembling *G. rufomaculans* [*Glomerella cingulata*] was somewhat prevalent in Florida on pomegranates, causing a decay of the blossom ends.

Pecans [*Carya pecan*] in Georgia were less subject to leaf spot (*Cylindrosporium caryigenum*) [ibid., vii, p. 254] than in the two previous years. The Stuart variety is placed in the susceptible category, while nine others, including Moore, Pabst, Van Deman, Schley, and Alley, showed varying degrees of resistance. Leaf blotch (*Mycosphaerella convexula*) [loc. cit.] was destructive in pecan nurseries during the latter part of the season. *Microstroma juglandis* [ibid., vii, p. 404] caused a spotting of pecan leaves in

Mississippi, while nursery seedlings in Florida, Mississippi, and Texas were attacked by *Phyllosticta caryae.*

RIKER (A. J.), KEITT (G. W.), & BANFIELD (W. M.). **A progress report on the control of crown gall, hairy root, and other malformations at the unions of grafted Apple trees.**—*Phytopath.*, xix, 5, pp. 483–486, 1929.

Promising results in the control of crown gall (*Bacterium tumefaciens*), hairy root, and other malformations occurring at the unions of grafted apple trees in nurseries [*R.A.M.*, viii, pp. 159, 249] have been obtained by wrapping the grafts with adhesive plaster or nurserymen's tape. The technique of the operation [which is briefly indicated] is very simple, and 350 to 400 grafts can easily be treated in an hour. The cost of this method is relatively small and is more than covered by the saving of one or two trees out of a hundred.

MUSKETT (A. E.) & TURNER (E.). **Apple scab and its control in Northern Ireland. Part I.**—*Journ. Min. Agric. Northern Ireland*, ii, pp. 26–42, 5 pl. [1 col., facing p. 1], 1929.

After stating that scab (*Venturia inaequalis*) is the most serious disease of apples in Northern Ireland and that the production of winter spores in fallen leaves is a highly important factor in the overwintering of the fungus on the susceptible Bramley's Seedling variety, the author gives a full account of the spraying tests conducted from 1924 until 1927, inclusive, for the control of the disease on this variety.

The results [which are tabulated] showed that trees which were sprayed with an excess lime Bordeaux mixture ($2\frac{1}{4}$–8–40) at pinking, petal-fall, and post petal-fall (three weeks after the second application) gave for the four seasons a total yield equivalent to 319 cwt. per 100 trees, as compared with only 35 cwt. for the same number of unsprayed trees. The percentage of clean fruit obtained from the sprayed trees averaged 69, as compared with 22·5 from the unsprayed trees, while the apples from the sprayed trees were also larger than the others and there was no appreciable russeting from the treatment. All the trees received a tar oil winter wash against insect pests which, however, gave no control of *V. inaequalis.* The addition of sugar or glue to the Bordeaux mixture increased its fungicidal value, this increased efficacy amounting to 10 per cent. during one season.

Lime-sulphur gave less satisfactory results, and Burgundy mixture (2–$2\frac{1}{2}$–40), though efficient as a fungicide, was reported to cause leaf scorching in certain districts.

If a late spraying six weeks after petal-fall is desirable, as appears to be the case in certain seasons, lime-sulphur 1 in 60 should be used, as Bordeaux mixtures leaves a film on the fruit.

The effects of the spraying were markedly cumulative; the sprayed trees being in much better condition and yielding a heavier crop in 1927 than in 1924.

The market value of the crop obtained during the four years from one hundred sprayed trees was £200 greater than that of the crop from an equal number of unsprayed trees; the total cost

of the spraying for the whole period amounted to £14 per hundred trees.

GARDNER (M. W.). **Sporotrichum fruit spot and surface rot of Apple.**—*Phytopath.*, xix, 5, pp. 443–452, 3 pl., 1929.

This is an expanded account of the author's researches on the fruit spot and surface rot of stored apples in southern Indiana, a preliminary notice of which has already appeared [*R.A.M.*, vii, p. 453].

The shallow, pale tan to light brown lesions on the affected fruit were 2 to 15 mm. in diameter, more or less circular with somewhat indefinite margins; the shrunken and dried out or soft, watery tissue was readily scraped from the underlying sound areas. The decayed tissues contained an abundance of the mycelium and spores of the causal fungus (which was identified, on the basis of comparative cultural and morphological studies, as a strain of *Sporotrichum malorum*) both between and within the large parenchyma cells. The latter were collapsed and separated, and many had lost their starch content.

The hyphae of *S. malorum*, averaging 4 μ in diameter at maturity, are sparsely branched and frequently form loops or simple coils, 10 to 12 μ across. Compound strands of parallel hyphae are produced in the aerial mycelium. Cylindrical or ellipsoidal, unicellular, hyaline conidia, 4·6 to 8·4 by 1·4 to 2·1 μ, are successively abstricted from the apices of the short, lateral, somewhat swollen conidiophores, which measure 5 to 8 μ in length and may reach 20 μ by continued elongation after the beginning of spore production. In the rotted tissues the conidiophores are frequently arranged in terminal or lateral clusters, somewhat suggestive of *Verticillium*, though with less definite whorls.

On potato agar the fungus produces a flocculent, buff-coloured or grey, aerial mycelium with a prostrate margin of radiating hyphae, on an olivaceous substratum. The acidity in dextrose agar is temporarily increased and starch is utilized. The optimum temperature for growth is from 19° to 27° C., with satisfactory development at 12°. Spore germination is readily affected over a wide range of temperatures and hydrogen-ion concentrations.

The pathogenicity of *S. malorum* was demonstrated by placing slabs from agar plate cultures on the unbroken skin of the fruit or by dipping apples in a spore suspension before storage. Infection was produced, apparently through the unbroken skin, lenticels, and wounds, on the Grimes, Jonathan, Winesap, Stayman, Rome, Wealthy, Ben Davis, and Gano varieties, and the fungus reisolated. A lengthy incubation period (nearly three months) was necessary for the formation of large lesions, those produced on freshly gathered apples being very small.

STRELIN (S. L.) & GORBAN (S. E.). Курчавость листьев Персика (**Exoascus deformans Fuck.**) на южном берегу Крыма. [Leaf curl of the Peach (*Exoascus deformans* Fuck.) on the southern coast of the Crimea.]—*Materials for Mycol. and Phytopath.*, vii, 1, pp. 185–190, 1 graph, 1928. [Received August, 1929.]

After a brief reference to the economic importance of the peach

in the Crimea and to the considerable damage done there by leaf curl (*Exoascus* [*Taphrina*] *deformans*), the author gives some details of control experiments which were made in 1927 at the Nikitsky Botanic Garden [Crimean south coast]. The best results were obtained by spraying the trees in the spring, at the swelling stage of the buds, with a 0·75 per cent. solution of copper sulphate, practically no disease appearing on the trees that were thus treated. The same spray applied after the emergence of the young leaves from the buds, during the setting period of the flowers, produced severe scorching, while a dormant spray with 2 per cent. Bordeaux mixture only gave a slight reduction in the incidence of the disease as compared with the controls.

FISH (S.). **Apricot scab or shot hole. A synopsis of three years' work on control conducted in the Goulburn Valley.**—*Journ. Dept. Agric. Victoria*, xxvii, 4, pp. 235–239, 2 graphs, 1929.

The results of three years' experiments (1926 to 1928, inclusive) in the control of shot hole of apricots (*Clasterosporium carpophilum*) in the Goulburn Valley, Victoria, are summarized [*R.A.M.*, vii, p. 730]. It was found that a thorough application of Bordeaux mixture 6–4–40, plus lime casein at the rate of 1 lb. per 100 galls., in the autumn (as the final leaves were falling) followed by a similar treatment at the pink bud stage, greatly reduced the incidence of shot hole (from 36·5 to 2·2 per cent. in 1928 and from 77·7 to 2·3 per cent. during the three-year period). The total cost of the treatment (which produced no adverse effects on the yield or appearance of the fruit) was sevenpence per tree.

NICOLAS (G.) & AGGÉRY (Mlle). **Cerasus caroliniana Michx., nouvel exemple d'andromonœcie. Un type nouveau de maladie bactérienne.** [*Cerasus caroliniana* Michx., a new example of andromonœcism. A new type of bacterial disease.]—*Comptes rendus Acad. des Sciences*, clxxxviii, 26, pp. 1693–1695, 1929.

Two Carolina cherry (*Prunus caroliniana*) trees in the Toulouse Botanical Garden have been affected by a disease characterized by the development of concentrically zoned spots, with a brown discoloration and partial desiccation of the leaves, followed by defoliation, the last-named symptom beginning in January and lasting until the commencement of a spell of dry weather in March or April. The young leaves developing in April show a desiccation of the tips and a pale green and yellow mottling resembling that due to mosaic. The young twigs are also desiccated. The roots and rootlets bear small brown lateral tumours, separated from the root axis by a cork layer and composed of fairly large cells densely filled with bacteria. No vessels are found in these tumours. Sometimes small, short, yellow, hypertrophied rootlets are found, the tissues of which are filled with bacteria, while in other cases, where hypertrophy is absent, the bacteria occur in small, spherical aggregations of brown cells surrounded by larger elements. This last condition is the early stage of the lateral tumours, the infected

group of cells becoming pushed out to one side by the reaction of the root.

Bacteria are also found in all parts of the plant, from the root to the flowers. The organism is a small, ovoid cell, occurring singly, in couples, or in groups of four, Gram-positive, staining with gentian violet, and liquefying gelatine. It is believed to be a soil saprophyte which penetrates the roots of trees weakened by unfavourable environmental conditions, assumes a parasitic form, and causes systemic infection.

JØRSTAD (I.). **Alkalisk burgundervæske, et utmerket middel mot Stikkelsbærdreperen.** [Alkaline Burgundy mixture, an excellent remedy for Gooseberry mildew.]—Reprinted from *Norsk Havetidende, 1929*, 6, 3 pp., 1929.

Continuing his experiments in the control of gooseberry mildew [*Sphaerotheca mors-uvae*: *R.A.M.*, vii, p. 35] at Rakkestad, Norway, the writer reports excellent results from the use of 1·5 per cent. Burgundy mixture, which is also stated to have proved very satisfactory in Holland. The proportions used in making the mixture were 1·5 kg. calcined soda and 1·5 kg. copper sulphate to 95 l. water. Two applications were given, on 16th June and 1st July in 1928. The percentage of healthy fruit on the Burgundy sprayed bushes in 1928 was 98·4, compared with 24·3 on the untreated controls, the corresponding figures for 1927 being 98·5 and 55·6, respectively. Fairly good control was also given by two applications of Hovde's melduggvask [mildew wash].

WINTER (J. D.). **Raspberry mosaic.**—*Journ. Econ. Entom.*, xxii, 3, pp. 486–490, 1929.

After giving brief notes on the symptoms of the five groups of virus diseases affecting raspberries [*R.A.M.*, vi, p. 675], viz., leaf curl, red raspberry mosaic, mild mosaic, yellow mosaic, and streak (only the first two occurring to any extent on red raspberries [*Rubus idaeus*], while black raspberries [*R. occidentalis*] suffer from all), the writer discusses the transmission of these conditions by aphids and the production of healthy stock through proper seed certification methods.

Only four species of aphids have been reported to be widely distributed on raspberries in North America, namely *Amphorophora rubi* [ibid., vii, p. 301], *A. rubicola* (identical, according to unpublished data of the writer, with *Aphis rubiphila*, which is also present), and *Amphorophora sensoriata*. Pending further information as to the exact rôle of each, all these species should be considered as potential vectors of the virus diseases. The insects have been found to show a decided preference for certain varieties. Thus, the writer's unpublished data indicate that *A. rubi* does not thrive on the Herbert variety, which is seldom affected in Minnesota.

The first roguing should be done in the spring as soon as the symptoms appear and before aphids become numerous. Red raspberries cannot, as a rule, be successfully rogued where over 5 per cent. of the hills are infected, but eradication is easier in the case of the black varieties and may consequently be attempted where the percentage of disease is higher. When aphids are abundant,

the infected plants should be burnt before digging or carried from the field in a suitable container and burnt before the foliage wilts. Owing to the frequent occurrence of winged forms of *Aphis rubiphila*, all plants suffering from leaf curl should be burnt. Aphids are readily conveyed from one planting to another on the workers' clothes.

The estimated production of certified Latham red raspberries in Minnesota in 1929 is about 4,000,000 plants. The incidence of infection in rogued plantings of this variety has steadily declined down to less than half of 1 per cent. for the 300 acres rogued in 1929. A disease-free zone of not less than 100 yards is maintained round each certified planting, but this distance has been found insufficient to ensure the production of clean stock in districts where infected plantings are numerous.

On 3rd March, 1928, the Central Plant Board, representing 13 States, adopted recommendations for the uniform inspection and certification of raspberry plants for all virus diseases except mild mosaic. These recommendations provide for two annual inspections, the eradication of all visibly infected plants, and a disease-free zone round each certified planting. Owing to the absence of standardization in various States in connexion with the inspection and certification of raspberry plants for virus diseases, special regulations have been enacted by New York, Michigan, Minnesota, and Wisconsin concerning the entry of raspberry plants. These regulations are substantially similar, except that Michigan includes mild mosaic but does not require a disease-free zone round each certified planting.

There is every reason to believe that immense damage is caused to the American bramble fruit industry by virus diseases, but this is very largely preventable by the use of clean planting stock. Hence the proper inspection and certification of raspberry plants is extremely important [see next abstract].

JOHNSTON (S.). **Selected Raspberry plants cut disease losses. Inspection of nursery stock permits selection of healthy stock for planting.**—*Quart. Bull. Michigan Agric. Exper. Stat.*, xi, 4, p. 198, 1929.

In the spring of 1925, a Cumberland black raspberry [*Rubus occidentalis*] plantation was established at the South Haven (Michigan) Experiment Station. One half (572 plants) was set with tips from apparently disease-free plants (Section A), while the other was planted with ordinary commercial material (Section B). During the first summer, nearly 100 plants in Section B had to be eradicated on account of mosaic or wilt [*Verticillium albo-atrum*: *R.A.M.*, viii, p. 295], while there was only one plant affected by the former disease in Section A. The following year B lost 75 plants and A only 6, the number of cases of fruit produced by each section being 5 and 26, respectively. In June, 1927, B was so heavily infected by mosaic and wilt that the whole section had to be destroyed, while A continued to give satisfactory yields (36 cases in 1927 and 50·5 in 1928). This experiment shows the great importance of using clean nursery stock in the establishment of plantations [see preceding abstract].

ZELLER (S. M.). **Another anthracnose of Raspberry.**—*Phytopath.*, xix, 6, pp. 601–603, 1 fig., 1929.

The wild black raspberry (*Rubus leucodermis*) in western Oregon and Washington has been observed, during the last five years, to be affected by an anthracnose due to a fungus agreeing with the description of *Gloeosporium allantosporum* Faut. and characterized by the development, in the autumn, of long, narrowly elliptical lesions, which are greenish-brown at first, later pale yellowish, and ultimately white or ashen with reddish-brown margins. Less frequently the disease has been found on the cultivated black raspberries [*R. occidentalis*] and the St. Regis red raspberry [*R. idaeus*]. The spots are less deeply sunken than those caused by *Plectodiscella veneta* on cultivated black raspberries, and their long, narrow shape contrasts with the almost circular oval spots caused by the latter fungus, which are often found on the same canes. The acervuli of *G. allantosporum* develop in the spring (February to June) following the first infection, and again during the next autumn; they are often so close together as practically to girdle the canes. The lesions caused by this fungus do not differ appreciably in appearance from those due to *Rhabdospora rubi* [cf. *R.A.M.*, viii, p. 288]. The application of Bordeaux mixture (4–4–50) just before the discharge of spores in the autumn controls the disease on canes grown during the current season.

DICKSON (B. T.). **Division of economic botany: some present activities.**—*Journ. Australia Council Sci. & Indus. Res.*, ii, 2, pp. 94–97, 1929.

The wet rot or 'water blister' of pineapple caused by *Thielaviopsis paradoxa* is stated to be prevalent in Queensland from November to April. Approximately 80 per cent. of the diseased pineapples examined were basally affected. *T. paradoxa* grows rapidly at ordinary temperatures, but is checked by high (37° C.) and low (10°) temperatures.

This disease annually occasions a loss of about 10 per cent., or some £7,000, plus £500 to £600 spent in transporting diseased fruit.

CADORET (A.). **Nouvelles maladies des Noyers en Savoie.** [New Walnut diseases in Savoy.]—*Comptes rendus Acad. d'Agric. de France*, xv, 18, pp. 684–686, 1929.

Walnuts in the cold and humid regions of Savoy have suffered heavy losses (up to 80 per cent. of the normal yield) through the attacks of a species of *Aspergillus*, which causes the fall of the nuts in June. The sole means of control appears to be the cultivation of late-maturing varieties which ripen their nuts during relatively warm and dry weather.

HEIN (D. C.). **Standardized Potato sprays and dusts.**—*Amer. Potato Journ.*, vi, 6, pp. 163–168, 1929.

The examination of manufacturers' samples of monohydrated copper sulphate has shown that 80 per cent. were too poor to make good dusts for fungicidal purposes. A good monohydrated copper

sulphate should be a fine, bright, nearly white powder, with a slightly bluish tint.

Grey, drab, or brownish samples with a dead, flat appearance contain copper oxide (useless as a fungicide) and have been over-processed or burnt in dehydration. Such material is stated to be on the market in large quantities.

Übersicht über die Organisation zur Beobachtung und Bekämpfung der Pflanzenkrankheiten in Preussen. Jahrgang 1927. [Survey of the organization for the observation and control of plant diseases in Prussia. Year 1927.]—*Statist. Nachweis Landw. Verwalt. Preussen*, pp. 213–218, 1929.

This survey, presented in tabular form, enumerates the plant protection headquarters (*a*) for agricultural and horticultural plants, and (*b*) for silvicultural plants, in the different provinces of Prussia, together with the districts under the observation of each headquarters and the localities in which agricultural colleges, consultation bureaux, and similar institutions are situated.

JACZEWSKI (A. A.). Краткий обзор современного состояния учения о вырождении у растений. [A summary of the present status of the study of degeneration diseases in plants.]—*Materials for Mycol. and Phytopath.*, Leningrad, vii, 1, pp. 195–207, 1928. [Received August, 1929.]

This is a brief, but very comprehensive, review of the work done up to date [much of which has been noticed in this *Review*] in the investigation of the so-called degeneration or virus diseases of plants. In discussing the various theories advanced in regard to the nature of the pathogenic agent, the author states that, in his opinion, the one that deserves the closest attention is that of a protozoan origin of the diseases, chiefly basing himself in this view on the recent investigations of Schaffnit and Weber [*R.A.M.*, vii, p. 108]. He is fully aware, however, of the controversial state of the question, and considers that much further work has yet to be done before arriving at a final conclusion. Especial stress is laid on the difficulties met with in all attempts to classify the virus diseases, owing to the very complex and variable character of their symptoms, sometimes even in one and the same host, and to the undetermined nature of the pathogen. He believes that a promising means of classification is furnished by the constant reaction of some viruses to certain chemical reagents, e. g., alcohol, mercuric chloride, nitric acid, &c., and to heat, in which regard the viruses behave very much as ferments and enzymes. Generally speaking, success in this arduous investigation can only be attained by close co-operation between physiologists, biologists, phytopathologists, and chemists.

BUCHHEIM (A. N.) & ORLOVA-BORISSOVA (Mme E. I.). К биологии мучнисто-росных грибов. [Contribution to the biology of powdery mildew fungi.]—*Morbi Plantarum*, Leningrad, xvii, 1–2, pp. 26–31, 1 graph, 1928. [German summary. Received August, 1929.]

Brief details are given of experiments which were carried out in Podolsk [west Russia] during the summer of 1925, in the course

of the senior author's study of the biology of the Erysiphaceae [*R.A.M.*, viii, p. 67], for the purpose of determining the influence of meteorological factors on the formation of the perithecia of the powdery mildews of *Alchemilla vulgaris* and *Caragana arborescens* [*Sphaerotheca humuli* and *Erysiphe polygoni*, respectively]. The results indicated a close relationship between temperature and the production of these organs in both species, a fairly constant sum total of 310° to 320° C. of daily mean temperatures from the moment of the first appearance of conidia being necessary to ensure their production. In the case of *E. polygoni* the period of time that elapsed between the appearance of the conidia and the formation of the perithecia was 5 or 6 days longer towards the end of the summer than in midsummer. Under natural conditions no regular correlation could be established between the relative humidity of the air and amount of precipitation, on the one hand, and the formation of perithecia, on the other.

WERNER (H. O.). **Effect of variable conditions within a field containing spindle tuber plants upon the seed value of the Potatoes produced.**—*Amer. Potato Journ.*, vi, 6, pp. 168–170, 1929.

The results of observations made during 1926–7 in north-western Nebraska, showed that spindle tuber [*R.A.M.*, viii, p. 358] was much more prevalent on low land than on high land potato stock, the mean total yield per tuber unit being 43·6 per cent. higher in the latter group. The use of only high land seed would have resulted in an increased yield of 17·9 per cent. as compared with planting equal amounts from all parts of the field. It is suggested that seed selection should be practised on high ground where the transmission of spindle tuber is less common and diseased stock is to some extent eliminated.

LINDFORS (T.). **Iakttagelser över Potatissorters förhållande till sjukdomar med särskild hänsyn till sorter som äro immuna mot Potatiskräfta.** [Observations on the reaction of Potato varieties to diseases with special reference to varieties immune from Potato wart.]—*Centralanst. för försöksväsendet på jordbruksområdet, Meddel.* 354, 26 pp., 1929. [German summary.]

The results [which are tabulated and discussed] of four years' experiments in potato fields infected with wart disease [*Synchytrium endobioticum*], near Kristiansand (Norway), showed that the following Swedish varieties are susceptible: Birgitta, Blända, Brita, and Greta (selected at Svalöv), and Imperia (Weibullsholm). Complete freedom from infection was shown by Sigyn (Weibullsholm) and some Swedish 'rural' varieties (white and red Jämtland, Leksand, Smedsby, and Vitaniemi).

The following wart-immune varieties also exhibited a high degree of resistance to *Phytophthora* [*infestans*] in Sweden: Beseler, Arran Consul, Hindenburg, Jubel, Parnassia, Arnica, and Kerr's Pink [ibid., vii, p. 595]. Pepo showed little foliage infection but a considerable amount on the tubers. The medium-early Majestic, King George V, Ally, and Great Scot varieties proved comparatively resistant to blight.

A high degree of susceptibility to mosaic was shown by the following wart-immune varieties: Dunvegan Castle, Dargill Early, Ally, white and red Jämtland, Smedsby, White City, and Celt. Probably the low yields of the Di Vernon variety are also due to general infection by mosaic, to which Kuckuck, Catriona, and Norna are also susceptible. The detrimental effect of mosaic on yield was shown by two experiments, in one of which healthy plants of the Wohltmann, Magnum Bonum, Bismarck, and Danusia varieties were artificially inoculated with the virus, resulting in an average decrease in tuber weight from 696 to 149 gm. per plant; in the other the weight of tubers from naturally infected plants (Wohltmann, Danusia, and Magnum Bonum) declined from 227 gm. per plant in 1922 to 225 gm. in 1923 and 196 gm. in 1924 [cf. ibid., vii, p. 802].

Virtual immunity from scab [*Actinomyces scabies*] was shown by Jubel and Hindenburg, while Arnica and Pepo were also very resistant to this disease.

MUSKETT (A. E.). **The control of ordinary or late blight of the Potato in Northern Ireland. I. Spraying versus dusting.** —*Journ. Min. Agric. Northern Ireland*, ii, pp. 54–62, 1 pl., 1929.

Tests conducted in County Down to compare Burgundy mixture with four proprietary copper sulphate dusts for the control of potato blight (*Phytophthora infestans*) showed that plots sprayed twice with 0·5 per cent. mixture gave an average increase in yield of 1 ton, 12 cwt. per acre and those dusted twice one of only 8 cwt., as compared with the untreated control plots. In three out of five tests the average yield of blighted tubers was 3, 7, and 10 cwt. per acre for the sprayed, dusted, and control plots respectively. In a further experiment plots sprayed twice with 2 per cent. Burgundy mixture yielded approximately 30 cwt. per acre more than those dusted twice. Dusting was also at least as expensive as spraying.

Lagen om Potatiskräftans bekämpande. [The decree relating to the control of Potato wart.]—*Landtmannen*, xii, 22, p. 479, 1929.

The Decree of 1st June, 1929, relating to the control of potato wart [*Synchytrium endobioticum*] in Sweden [*R.A.M.*, viii, p. 123], provides for the immediate notification to the phytopathological authorities of suspected cases of disease. Infected potatoes and plant refuse must be boiled before use as fodder, or burnt if not required for this purpose. No tubers, foliage, soil, compost, or refuse may be removed from infected areas, while the implements, &c., used in such areas must be disinfected with a formalin solution containing at least 2 per cent. formaldehyde before they can be employed elsewhere. Potatoes may not be cultivated in infested fields during the year following the detection of wart disease. The use of immune varieties (procurable from the Central Institute) is compulsory in the infected areas. Compensation is allowed in certain cases where potatoes are confiscated on account of infection.

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DEAN (D.). **Potato spraying in New York.**—*Amer. Potato Journ.*, vi, 6, pp. 175–177, 1929.

Under up-State New York conditions 5 to 15 applications of Bordeaux mixture are stated to be necessary for the control of late blight of potatoes [*Phytophthora infestans*]. Large, dense crops of the Green Mountain type need more frequent applications than the smaller Rural plants. Experiments at Geneva (New York) have shown that the disease may be controlled by spraying with hand pumps at pressures of 80 lb. and below, but in such cases very large quantities of Bordeaux mixture (300 to 400 galls. per acre) must be used. The writer, however, has found that the best results are obtained by a 6 h.p. motor sprayer working at 300 lb. pressure. Weekly to fortnightly applications should be given, with special attention to weather bureau warnings of the approach of large storm areas [cf. *R.A.M.*, vii, p. 665].

BONDE (R.). **Physiological strains of Alternaria solani.**—*Phytopath.*, xix, 6, pp. 533–548, 1 fig., 1 diag., 1929.

This is an expanded account of the author's investigations on the occurrence of physiological strains in *Alternaria solani* isolated from potato tubers, a preliminary note on which has already been published [*R.A.M.*, vi, p. 506].

The strains can be differentiated on the basis of spore production, the formation of pigment in potato agar, the rapidity of growth, the appearance of the mycelium in culture, the development of lesions on detached leaves and tubers, and frequency of saltations.

Spore production was found to require particular conditions, involving the laceration and partial desiccation of agar cultures. The strains were found to vary greatly in their capacity for sporulation in culture, some scarcely ever producing spores. They could not be distinguished on the basis of spore dimensions, which varied as much in different cultures of the same strain as in cultures of different strains.

Most of the original strains isolated from the tubers were chromogenic on potato agar, turning it red. Others were non-chromogenic,

while some were intermediate or variable in this character. The pigment is an indicator which in aqueous or alcoholic solution turns from yellow on the acid side, to deep red or carmine on the alkaline side, of about P_H 7·8. Temperature was found to influence the amount of pigment produced by certain intermediate chromogenic strains, the maximum amount being formed at 25° to 30° C. (which was also the optimum temperature for growth), while below 15° pigmentation may be entirely inhibited. All the strains increased the P_H value of potato agar from about 6·6 to 8·3. Non-chromogenic strains rendered potato agar toxic to the chromogenic ones and prevented pigment formation by the latter.

Highly significant differences in the pathogenicity of certain strains of *A. solani* were revealed by the inoculation of potato leaflets or tubers with sterile mycelium in damp chambers. For instance, strains I–1 (a tuber isolation which has maintained its virulence for four years on artificial media) was highly pathogenic to tubers but less to leaves, while the reverse holds good for some of the other tuber isolations.

EDWARDS (E. E.). **The control of a serious Potato trouble.**—*Journ. Min. Agric.*, xxxvi, 3, pp. 234–242, 2 pl., 1929.

For some years past growers in Lincolnshire, Yorkshire, and other parts of England have suffered heavy losses from an obscure disease of potatoes due apparently to combined infestation by the eelworm *Heterodera schachtii* and infection by the fungus *Corticium solani*. In severe cases the crop may be almost a complete failure, while, once the trouble becomes established, it appears to preserve its intensity year after year. In Lincolnshire first and second early varieties may also be seriously attacked.

The first symptom is the poor growth of the plants in early summer. The leaves of an affected plant become mottled green or yellow and the apical margins of the leaflets turn brown. The browning becomes more pronounced as the leaves grow older; the margins of the leaflets roll upwards and inwards, and finally the diseased leaves wither. The symptoms usually first affect the lower leaves and progress upwards. Affected plants seldom recover.

Control tests were made under field conditions, various [named] chemical disinfectants being applied to the soil. The best results were given by an application at the rate of 8·5 cwt. per acre of drained creosote salts (a crude form of naphthalene containing small quantities of other coal-tar derivatives), the plots so treated giving an increased yield of approximately 4·5 tons per acre over the untreated control plots, with an increased net profit of over £18.

DEMOUSSY. **La résistance des microorganismes du sol aux basses températures de l'hiver dernier.** [The resistance of soil micro-organisms to the low temperatures of last winter.]—*Comptes rendus Acad. d'Agric. de France*, xv, 19, pp. 697–700, 1929.

Counts made of the bacteria and fungi in samples of soil from a Paris garden early in January, and again at the beginning of

February, 1929, showed that neither of these categories was adversely affected by the extremely low temperatures then prevailing (−13° C. for several days in succession) [cf. *R.A.M.*, vii, p. 740].

CARPENTER (C. W.). **Pathology.**—*Proc. Hawaiian Sugar Planters' Assoc., Forty-eighth Ann. Meeting, 1928*, pp. 331–336, 1929.

After six years' absence the writer has resumed his investigations of Lahaina root rot of sugar-cane [*R.A.M.*, viii, p. 266], which he believes to be a specific disease, the primary factor in the causation of which is *Pythium aphanidermatum* [ibid., vii, p. 488]. This fungus and another related form (the exact rôle of which has not yet been determined) were the only significant organisms almost invariably present in seven Lahaina plots showing the characteristic symptoms of root rot, viz., slow growth, pale green to yellowish foliage, few leaves arranged fan-wise at the tops of short-jointed, weak canes, ready detachment of the stools from the soil, and a generally starved appearance. Many stools and groups of stools were severely stunted and badly decayed. Of a representative fungous flora, comprising 15 strains, isolated from cane roots in the plots, only *P. aphanidermatum* produced root rot of Lahaina cane, grown on sterilized soil at Waipio, by inoculation. The diseased canes offered a striking contrast to the adjoining plots of Yellow Caledonia.

P. aphanidermatum grows at a hydrogen-ion range comparable to that of the soils in the affected districts of Hawaii. Zoospores were found to be readily produced at a temperature of 60° F. The fungus is widespread in Hawaiian cane fields and is often observed on a few roots of the resistant standard varieties. The Java cane E.K. 28 is believed to be even more susceptible than Lahaina.

Lahaina root rot has been observed to begin or culminate in years of unusually low rainfall between 1887 and 1919. The working theory is advanced that susceptibility to this disease is acquired or lost in the soil, the capacity of *Pythium* to enter the roots depending on the nature and amount of the nutrients absorbed by the plants. It is believed that, in the field, excesses of a by-product of accelerated trash and stool decomposition result in a susceptible type of root growth. The application of nitrogen supplies an essential element to the cellulose-fermenting bacteria, thereby accelerating the formation of the substance affecting susceptibility. Since nitrates in large amounts induce a susceptible type of root growth, it is thought that the compost disintegration product favourable to the disease may be nitrogenous in character. According to this theory, therefore, Lahaina cane is susceptible to root rot when over-supplied with nitrates or products of cane trash in decomposition.

[This paper is reprinted in *Internat. Sugar Journ.*, xxxi, p. 368 1929.]

EDGERTON (C. W.), TIMS (E. C.), & MILLS (P. J.). **Relation of species of Pythium to the root rot disease of Sugar-Cane.**—*Phytopath.*, xix, 6, pp. 549–564, 1 pl., 5 figs., 1929.

Root rot of sugar-cane in Louisiana [*R.A.M.*, v, p. 633; vi, p. 641]

is associated with a number of factors, of which only the relation of fungi to the condition is discussed in this paper.

The roots of affected canes are short, crooked, and branched, with few fibrous rootlets, which seem to rot off as rapidly as they develop. A diseased condition, similar to that occurring in the field, has been induced in hundreds of young plants by inoculation with pure cultures of a *Pythium* commonly found on decaying roots. This fungus does not readily produce any kind of fruiting bodies on ordinary culture media. Oospores have been observed in roots from the inoculation experiments, in maize roots growing under aseptic conditions in large test tubes [cf. ibid., vii, p. 778], and also on fresh, clean cane roots inoculated with a pure culture of the organism in sterile water in Petri dishes. In addition to the ordinary type of mycelium, the fungus produces numerous globular, lobed, or irregular bodies, sometimes considerably branched, resembling the presporangia described by Edson in *P. aphanidermatum*, but all attempts to develop zoospores from them have failed. They appear to germinate by means of small germ-tubes. The *Pythium* studied by Carpenter in Hawaii as a cane root parasite has been determined by him as *P. aphanidermatum* [see preceding abstract], but this is considered by the writers to be incorrect, since *P. aphanidermatum* attacks a number of plants on which the sugar-cane *Pythium* is non-parasitic, and Drechsler [ibid., viii, p. 168] has shown that the two fungi differ also in morphological characters.

A gradual loss of virulence was observed in a culture of the cane *Pythium*, originating from a single mycelial hypha, during a period of two years on bean pod agar.

The results [which are tabulated] of a survey conducted during January and February, 1928, as well as those of inoculation tests, showed that other forms of *Pythium*, some of which are capable of attacking cane, maize, sorghum, wheat, and (to a slighter extent) oat roots, are widespread in Louisiana. No attempt has yet been made to identify these organisms. The variable activity of the root-rotting fungi is attributed to their dependence on a complex of environmental factors, of which heavy rainfall and poor drainage conditions appear to be the most important in Louisiana.

MARTIN (J. P.). **Pathology.**—*Proc. Hawaiian Sugar Planters' Assoc., Forty-eighth Ann. Meeting, 1928*, pp. 337–340, 1929.

Sugar-cane mosaic in Hawaii [*R.A.M.*, vii, p. 742] is stated to be kept under control by the substitution of the resistant D. 1135 variety for the highly susceptible Yellow Tip. Encouraging results have also been obtained on a number of plantations by roguing and weed control.

The outstanding measure for the control of eye spot [*Helminthosporium ocellum*: ibid., viii, p. 134] is the cultivation of highly resistant commercial canes in the most severely affected areas, where the late planting of susceptible varieties should be avoided, as also should late harvesting and heavy late applications of nitrogenous fertilizers. The ultimate control of the disease depends on the development of a resistant variety equalling or excelling the susceptible H. 109, and with this object in view over

400 varieties are now under observation in affected localities at Waialua.

BARNUM (C. C.). **Pathology.**—*Proc. Hawaiian Sugar Planters' Assoc., Forty-eighth Ann. Meeting, 1928*, pp. 341–344, 1929.

Reduced applications of nitrogen to H. 109 sugar-cane in areas affected by eye spot [*Helminthosporium ocellum*: see preceding abstract] are stated to have proved beneficial pending the replacement of this susceptible variety by a resistant one. The application to the soil of varying amounts of potash and phosphorus failed to increase resistance to eye spot in 84 plots at the Lihue Plantation Company. Continuous daily records at this plantation proved that high relative humidity and intermediate temperatures over lengthy periods were always followed by severe outbreaks of eye spot. At the height of the eye spot season the best control was obtained with weekly applications of oxidized sulphur dust (with 5 per cent. potassium permanganate), the average number of spots per leaf on the treated plots being 82 compared with 120 in the controls. The application of nitrogen at the rate of 30 lb. per acre early in September, 1927, resulted in the killing from eye spot attack of 25·7 per cent. of the stalks of H. 109 in 10-line plots, while in adjacent plots receiving 100 lb. per acre the corresponding injury amounted to 40 per cent.

WELLER (D. M.). **Pathology.**—*Proc. Hawaiian Sugar Planters' Assoc., Forty-eighth Ann. Meeting, 1928*, pp. 345–349, 1929.

The causal organism of eye spot of sugar-cane [*Helminthosporium ocellum*: see preceding abstracts] has been found to gain admission to the leaf tissues principally through the motor cells, where the leaf cuticle is very thin. It appeared to enter by mechanical pressure, rather than by enzyme action, passing through the soft parenchyma between the vascular bundles and ultimately entering the chlorophyll-bearing tissue. The hyphae are found only in a restricted area surrounding the point of infection and not in the reddish streaks of decayed tissues between the bundles. They emerge through the rotted tissue on either leaf surface, where conidia are freely produced on the conidiophores.

Magnesium, potassium, and sodium soaps of fatty acids move readily along the cell walls to the leaf surfaces on account of their solubility in cellulose, whereas a calcium soap of a fatty acid, being insoluble in cellulose, remains in or on the cell wall where it has been laid down. It is to be expected, therefore, that a high magnesium, potassium, or sodium content in the soil would result in a relatively thick cuticle on the leaves, while large amounts of calcium would cause the formation of a comparatively thin one. In a pot experiment the inoculated plants grown in soil with a high calcium content showed 67·2 per cent. more lesions than the controls, in accordance with this expectation.

During 1927–8 a study was made of the number of eye spot spores in the air at different times of the day and night. It was found that the numbers reached a maximum between 10 and 11 a.m. and again from 4 to 5 p.m.

NANNIZZI (A.). **Note micologiche.** [Mycological notes.]—*Atti R. Acad. Fisiocritici Siena*, Ser. X, iv, 1–2, pp. 87–96, 1929.

Notes, accompanied by Latin diagnoses, are given on the following fungi observed by the author. *Phyllosticta sassafras* Cke was found (apparently for the first time in Europe) causing a yellow discoloration and shedding of *Sassafras officinalis* leaves in the Siena Botanical Garden in October, 1928. Frequently associated with this organism was a new form of *Sphaerella sassafras* Ell. et Ev., which is termed forma *major*. Vine leaves attacked by the mite *Phytoptus vitis* were observed, in November, 1928, to bear the pycnidia of *Dendrophoma pleurospora* forma *vitigena* Sacc. Living foliage of an undetermined species of *Anona* was infected by *Cladosporium anonae* n. sp., characterized by simple, erect, often septate conidiophores, 240 to 300 by 4·8 to 5 μ, acrogenous, ovate or ellipsoid, subhyaline, uni- or more rarely triseptate conidia 6·7 by 4 to 4·2 or 10 to 11 by 4·8 to 5 μ, and producing oval or elliptical, yellowish spots with brown centres, mostly on the lower side of the leaves, which eventually dropped.

KANTSHAVELI (L.). Новые виды грибов из Грузии. [New species of fungi from Georgia.]—*Morbi Plantarum*, Leningrad, xvii, 1–2, pp. 81–94, 2 pl., 1928. [Received August, 1929.]

Descriptions and Latin diagnoses are given of two new genera and 13 new species of fungi which were collected in 1926 and 1927 in Georgia [Transcaucasia], and among which the following may be of phytopathological interest. *Massarina eucalypti* on dead branches of a species of *Eucalyptus*, on which it forms single or sub-gregarious, ellipsoidal or globose, sometimes applanate, immersed perithecia, 150 to 225 μ in diameter, with a short papilla; the asci are obclavate, paraphysate, and 70 to 75 by 15 to 19 μ, containing eight irregularly disposed, oblong-ellipsoidal, straight or slightly curved, hyaline spores, 20 to 21 by 6·5 to 8 μ, which are constricted into two unequal portions, the upper broader and two-septate, and the lower narrower and one-septate. *Botryosphaeria bondarzewi* on dead vine branches forms black, plectenchymatous stromata, at first subcortical but later emerging in long, cushion-like parallel rows, which occasionally coalesce; the emergent portion is parenchymatous, with thick-walled, brown cells, 10 to 15 by 8 to 11 μ in diameter. The perithecia are free, sessile on the stroma, pear-shaped, thick-walled, 500 to 750 by 200 μ in diameter, and with a beak from 150 to 200 by 70 μ. The paraphysate asci are clavate, developing from the base of the perithecium, and measure 150 to 200 by 20 to 23 μ; the spores eight, distichous, rhomboido-ellipsoidal, rarely with tapering ends, and 26 to 29 by 7 to 11·5 μ. *Scyphospora* n. gen. (Melanconiaceae Phaeosporeae) is based on *S. phyllostachidis* which was found on a living *Phyllostachis* sp. in the Tiflis Botanic Garden. It formed flat or concave, subepidermal but later erumpent acervuli with slender, two- to three-septate, mostly incrusted conidiophores, 35 to 46 μ long by 2 to 3 μ in diameter; the conidia are cup-shaped, continuous, rounded at their distal end, brownish, 14·5 to 16 by 12 to 14·5 μ, and arise singly on the apex of the conidiophore. *Macrophoma phaseolicola,* on living stems and pods of *Phaseolus vulgaris*, forms single or densely

grouped, rounded, black pycnidia, 120 to 200 μ in diameter, with a non-extruded ostiole up to 25 μ thick; the conidiophores are short, inconspicuous, and bear spindle-shaped, hyaline conidia, 25 to 30 by 5·5 to 6 μ, with a dense, granular content. This species is stated to differ from *M.* [*Macrophomina*] *phaseoli* and *Macrophoma phaseolina* in the size of its pycnidia and in the shape and size of its spores, the differences between the three species being given in a comparative table.

PURDY (HELEN A.). **Immunologic reactions with Tobacco mosaic virus.**—*Journ. Exper. Med.*, xlix, 6, pp. 919–935, 1929.

Separate antisera were produced in rabbits to normal sap from healthy Turkish tobacco plants and to virus sap from mosaic ones [*R.A.M.*, vii, p. 409]. The immunologic reactions of the antisera were studied by means of alexin-fixation tests; precipitin-absorption tests with the same tobacco virus multiplied in tobacco, tomato, pepper [*Capsicum annnum*], and petunia plants; and experiments with the inactivation properties of both antisera and normal serum on virus sap.

The results [which are tabulated] of these experiments showed that the normal and virus saps of tobacco possess common antigenic substances. The normal and virus saps of tomato, pepper, and petunia plants contain antigenic substances in common with normal tobacco sap. The virus saps of tomato, pepper, and petunia possess antigenic substances in common with the virus sap of tobacco, which are either absent or present only in small quantities in normal tobacco sap.

The two antisera possess alexin-fixing antibodies and precipitins in common. All the precipitins to normal tobacco sap may be removed from either antiserum by absorption with the virus sap of tobacco. Specific precipitins for virus sap of tobacco, tomato, pepper, and petunia are present in the antiserum to tobacco virus sap and cannot be removed by complete absorption with normal tobacco sap. Appropriate quantities of the antiserum to the virus sap of tobacco are capable of completely inactivating the virus sap. This preventive action is not manifested by corresponding quantities of antiserum to normal tobacco sap, or normal rabbit or guinea-pig serum. There is some evidence that a lytic specific antibody to virus sap is present in the homologous antiserum.

HORNBY (A. J. W.). **Report of the Agricultural Chemist.**—*Ann. Rept. Dept. of Agric. Nyasaland Protectorate, 1928*, pp. 14–18, 1929.

The following items of phytopathological interest are contained in this report. Frog eye of tobacco (*Cercospora nicotianae*) [*R.A.M.*, vii, p. 618] was the principal disease affecting the crops on the Matiti and Zomba Stations, where a few plants also showed symptoms of hollow stalk (*Bacterium* [*Bacillus*] *carotovorus*) [ibid., vii, p. 204]. A serious outbreak of this disease, primarily due to heavy rains during and following topping and suckering operations, was observed elsewhere. It is pointed out that the common use of the term 'stem rot' for the slimy decay of the pith caused by *B. carotovorus* is misleading, since this name is better restricted to the

diseases due to *Rhizoctonia* [*Corticium*] *solani*, *Sclerotium rolfsii*, and species of *Pythium* [ibid., viii, p. 204], isolated examples of which were observed during the year. A severe epidemic of a disease reported to be due to *P. aphanidermatum* [loc. cit.] but with the characteristic symptoms of black shank, as reported from Florida [*Phytophthora nicotianae*: ibid., viii, p. 471] occurred in 1928. The infection is believed to have originated in plants procured from a nursery in 1925 and 1926.

HOWARD (N. O.). **A new disease of Douglas Fir.**—*Science*, N.S., lxix, 1799, pp. 651–652, 1929.

Douglas firs (*Pseudotsuga taxifolia*) growing on sandy soil at the Goddard Memorial Park, Rhode Island, were found, in the autumn of 1927, to be suffering from an apparently new disease of which the most striking symptom is extensive resinosis, involving the lower 10 to 15 ft. of the main trunk. The condition is almost entirely restricted to older trees, of which 90 per cent. are affected in certain parts of the park. Cases were observed in which the trunks were covered with the dry, greyish-white, glistening resin flux, which in extreme cases may flow out over the ground for a foot or more from the base of the tree. Pitch pockets, sometimes containing half-a-pint or more of liquid resin, may occur beneath the bark of the lower portions of the trunk, which may also exhibit hypertrophies. Minute, white to tawny, cup-shaped apothecia of a species of *Dasyscypha*, with golden-yellow to orange hymenial surfaces, are usually found on the hypertrophied parts.

Sections of the swollen parts of living branches disclosed an abnormal number of bark layers, apparently formed as a result of excessive activity of the phellogen. Many cell layers of the periderm were found to be penetrated by the hyphae of the fungus, but whether the latter is directly responsible for the abnormal activity of the phellogen is still uncertain. It seems highly probable that the resinosis arises as a reaction to a wound stimulus, and not, as in certain cases observed by Sorauer, in a purely autogenous manner.

The condition of the Douglas firs on Rhode Island is stated closely to resemble that of the same trees at Hamilton and Ipswich, Massachusetts, where heavy damage has been caused by the larch canker fungus, *D. willkommii* [*D. calycina*: ibid., viii, p. 424].

STILLINGER (C. R.). **Dasyscypha fusco-sanguinea Rehm on Western White Pine, Pinus monticola Dougl.**—*Phytopath.*, xix, 6, pp. 575–584, 1 pl., 1 fig., 1929.

During the last eight years the writer has observed, in the western white pine (*Pinus monticola*) belt of northern Idaho, north-eastern Washington, and north-western Montana, a common but hitherto unreported canker of this tree liable to confusion with blister rust (*Cronartium ribicola*), and also resembling the destructive larch canker due to *Dasyscypha calycina* [see preceding abstract].

The causal organism of the new disease is believed to be a parasitic form of the normally saprophytic *D. fusco-sanguinea*, characterized by clavate, hyaline asci measuring 115 to 120 by 8 to 10 μ,

ascospores 16 to 20 by 6 μ, and yellowish-brown hairs. The dimensions of the asci and ascospores of the saprophytic form of the fungus are 70 by 10 and 15 by 5 μ, respectively, and the hairs are reddish-brown. The measurements of the parasitic form approximate to those of *D. calycina* as originally described, but not to Hiley's amended dimensions (asci 140 to 200 by 9 to 15 μ and ascospores 17 to 23 by 8 to 10 μ), while the hairs in both descriptions of *D. calycina* are stated to be hyaline. It is pointed out that the original description of *D. calycina* was probably based on the saprophytic form of this fungus, since specimens of the latter collected by Boyce in England in 1927 on very small twigs agreed with the earlier account.

The symptoms of the western white pine canker are fully described and compared with those of blister rust. On young trees the incipient stages of both diseases are very similar, and great care must be exercised in their differentiation. The original infection with *D. fusco-sanguinea* appears to be through the needles and results in a brownish, shrunken condition of the bark at the base of the needle cluster, while *C. ribicola* causes an orange discoloration, generally accompanied by a slight swelling of the whole area. These differences may be somewhat obscured by an abundant flow of resin in both cases. After one year's growth, however, the two diseases are readily distinguishable. Each year's growth of the *Dasyscypha* canker is definitely indicated by a marginal ring of broken bark or by a slight raised area at the edge, while apothecia are produced in large numbers on the past year's growth. On the blister rust canker the yellowish-brown pycnidial spots occur where the fungus has been present for more than a year, and shortly afterwards the bark is ruptured by the extruding aecidia.

The only other tree on which a similar canker was found was a western larch (*Larix occidentalis*), on which the fungus seemed to be identical with that on *P. monticola*, except that the apothecia were of a lighter colour.

LUTZ (L.). **Sur l'influence exercée par le support sur les caractères morphologiques du Polypore du Bouleau. Contribution à l'étude du tanin anti-oxygène.** [On the influence exerted by the substratum on the morphological characters of the Birch *Polyporus*. A contribution to the study of anti-oxygen tannin.]—*Bull. Soc. Myc. de France*, xliv, 4, pp. 328–330, 1 fig., 1929.

After referring to his earlier paper on the specific relation of some wood-attacking fungi to their hosts [*R.A.M.*, v, p. 269] and pointing out that although oak normally is not attacked by *Ungulina betulina* [*Polyporus betulinus*] it becomes susceptible when part of its tannin content has been removed by soaking in water at 120° C., the author states that some months after the white mycelium of *P. betulinus* was sown aseptically on a soaked block of oak which was then sterilized and placed in a hermetically sealed bell-jar, sporophores were produced. The mycelium first turned yellow, then brown, and soon ceased to grow on the surface, while it penetrated the heartwood of the block. Months later a white mycelial mass emerged from the bark and rapidly grew to the size of a

walnut, turning fuliginous brown with dark spots. A white protuberance appeared on this, which soon turned brown and developed into a stalk some 10 cm. long, at the end of which a pileus developed, at first white, then brown. New protuberances formed on the pileus and underwent the same colour changes. A portion of the mycelium grown on an artificial medium and transferred to birch wood gave a culture which remained white.

The brown colour developed on oak is attributed to the absorption of tannin from the wood and its progressive oxidation in the air and by the oxidizing enzymes of the fungus itself.

RUMBOLD (CAROLINE T.). **Blue-staining fungi found in the United States.**—*Phytopath.*, xix, 6, pp. 597-599, 1929.

Among the blue-staining fungi found infecting the sapwood of deciduous trees and conifers in the United States and Canada, *Ceratostomella* and *Graphium* [*R.A.M.*, vii, p. 683] occur in the greatest profusion of forms in the forests, where various other fungi, including pycnidial forms (possibly of *Valsa*) and non-staining moulds, are also present. *C. pilifera* [ibid., vii, p. 212] is the predominant organism in timber yards, while *G. rigidum*, causing a grey or bluish stain, frequently accompanies it. Some moulds and *Valsa*-like species also occur, both in the timber yards and (together with an undetermined black mycelium) on heated or dried wood. The latter is free from *Ceratostomella* and *Graphium*. The incidence and distribution of the wood-staining fungi found in a series of isolations from the timber of 18 genera of trees is shown by means of a table.

VANINE (S. I.). **О стойкости древесины различных пород дерева в отношении домовых грибов.** [On the resistance to house fungi of the wood of different species of trees.]—*Morbi Plantarum*, Leningrad, xvii, 1–2, pp. 68–81, 1928. [German summary. Received August, 1929.]

After a brief reference to the results obtained by earlier workers in the investigation of the relative resistance of different species of wood to the action of rot-inducing fungi, with particular reference to *Merulius lacrymans*, the author gives some details of the method by which he tested the wood of eleven species of trees for their resistance to decay caused by *Coniophora cerebella*. Briefly summarized, the method consists in establishing the loss of absolute weight in wood samples subjected for a period of four to five months to the action of pure cultures of the fungus in Erlenmeyer flasks. The woods thus tested fell into three groups. (1) Rot-resistant: yew, mahogany, and locust tree (*Robinia pseudacacia*). (2) Fairly resistant: pine, fir, cedar, alder, and *Phellodendron amurense*. (3) Little resistant: birch, lime [*Tilia*], and aspen.

NAOUMOFF (N. A.). **Материалы по изучению Капустной килы. II.** [Contribution to the study of club root of Cabbage. II.]—*Morbi Plantarum*, Leningrad, xvii, 1–2, pp. 51–65, 1928. [French summary. Received August, 1929.]

In referring to his previous investigation of the biology of the causal organism of cabbage club root [*Plasmodiophora brassicae*:

R.A.M., v, p. 528] the author points out the large number of questions that still remain to be elucidated in the study of the disease, both intra- and extramatrically, and gives a summary account of the work which was started by him in 1926 and is still in progress for the purpose of arriving at a solution of these problems.

Preliminary experiments during 1926 and 1927 [full details of which are given] would indicate that under natural conditions in the neighbourhood of Leningrad the parasite cannot live longer than three consecutive years in the soil, in the absence of its host. The optimum conditions for its preservation in the soil and for its further development appear to be a combination of high temperature and high humidity. Contrary to expectations, the addition of stable manure to the soil did not stimulate the germination of the *P. brassicae* spores and the infection of cabbage seedlings, but appeared to exert a somewhat detrimental action on the parasite.

Although the number of spores in the soil was shown to have some bearing on the intensity of infection of the seedlings, no direct correlation could be established between the two. There also was experimental evidence that the spores behave very differently in different soils [see next abstract].

FEDOTOVA (Mme T.). Бактерии сопутствующие **Plasmodiophora brassicae Wor.** и взаимоотношения их с паразитом. [Bacteria accompanying *Plasmodiophora brassicae* Wor. and their relationship to the parasite.]—*Materials for Mycol. and Phytopath.*, Leningrad, vii, 1, pp. 155–178, 4 graphs, 1928. [Received August, 1929.]

The investigation reported in some detail in this paper was started at Detskoye Selo [near Leningrad] for the purpose of elucidating the part, if any, played in the life-cycle of *Plasmodiophora brassicae* by the bacteria which have been reported by previous workers to be constantly associated with the parasite in club root lesions of crucifers, and the presence of which has been considered by some authors to be necessary for the germination of its spores in culture. After giving a brief review of the relevant literature, the author describes a method, based on the high resistance of the spores of *P. brassicae* to mercuric chloride, by which she succeeded in freeing the organism from the accompanying bacteria. Water suspensions obtained from crushed tissues of club root tumours from cabbage were subjected for 5 minutes to the action of a 1 in 1,000 mercuric chloride solution, after which the liquid was diluted by the addition of 20 volumes of sterilized water. The treatment but slightly affected the viability of the *P. brassicae* spores, which was tested by the plasmolytic method, preliminary experiments having shown that the viable spores are plasmolysed by a 27·5 per cent. solution of cane sugar. In spores thus plasmolysed, the protoplasm contracts excentrically, collecting to one side of the spore, but when returned to pure water it soon again fills the whole of the interior.

The results of infection experiments of healthy cabbage seedlings in pots [details of which are given] showed that spore suspensions of *P. brassicae* freed from bacteria in the manner described were

at least as pathogenic as mixed suspensions. They also proved that the infective power of the organism is largely dependent on the nature of the soil [see preceding abstract], since in the series of pots filled with ordinary grey garden earth 66 per cent. infection was obtained with a contamination of the soil of the order of 40,000 spores per c.c., while in a parallel series in blackish greenhouse earth a maximum infection of 12·5 per cent. only resulted with a contamination of the order of 100 million spores per c.c. of soil, even under optimum conditions for the development of the disease.

The results of the histological and bacteriological examination of the infected cabbage seedlings indicated that the root systems of the seedlings were free from bacterial infection before invasion by *P. brassicae*, neither could bacteria be detected in plants showing the first visible symptoms of infection. Bacteria began to appear in the club root tumours only on the fourth day after the development of the first symptoms, while the first signs of rotting became apparent from one week to five months later. The inference is that *P. brassicae* enters the tissues of the host alone, unaccompanied by any rot-inducing bacteria, and that the latter are secondary organisms. This was confirmed in part by the fact that attempts to infect healthy cabbage seedlings with pure cultures of a few species of bacteria isolated from club root tumours, either singly or in various combinations, gave negative results. It is emphasized, however, that the work only bore on rot-inducing bacteria, the determination of the presence in the tumours of other kinds being left over for further investigation.

[A German version of this appears in *Phytopath. Zeitschr.*, i, 2, pp. 195–211, 2 graphs, 1929.]

PIERCE (W. H.) & HUNGERFORD (C. W.). **A note on the longevity of the Bean mosaic virus.**—*Phytopath.*, xix, 6, pp. 605–606, 1929.

On 20th February, 1929, from 10 to 25 seeds of each of a number of bean [*Phaseolus vulgaris*] varieties, originally collected in Idaho in 1877 and stored since 1899 in glass vials, were planted in the greenhouse. Of two plants of an unnamed black wax variety that grew from these seeds, one immediately exhibited mosaic mottling in the two cotyledons, and as new leaves appeared they showed similar symptoms. The affected foliage was abnormally long and narrow, but displayed no curling of the margins. On 22nd March, macerated material from the mottled leaves was inoculated into 12 healthy Great Northern bean plants, 10 of which contracted infection during the first week of April, thus showing conclusively that the bean mosaic virus has remained viable within the seed for at least thirty years [*R.A.M.*, vii, p. 418].

BALAKHONOFF (P. I.). **К вопросу о вспышках мильдью Виноградной лозы.** [On the question of outbreaks of mildew of the Vine.] *Morbi Plantarum*, Leningrad, xvii, 1–2, pp. 65–68, 1928. [Received August, 1929.]

Vine mildew [*Plasmopara viticola*] is stated to be very prevalent in the Astrakhan and Don river regions [south-east Russia]; in

rainy years, e. g., in 1925, the disease frequently causes the loss of 75 to 100 per cent. of the crop, while in dry seasons the damage caused by it is but small, this being in full agreement with observations published by other authors. In 1926 and 1927, however, which were marked by dry conditions during late spring and early summer, with normal rainfall in the second half of the summer, the mildew developed to a very slight degree at first, almost entirely disappeared from the middle of May to the middle of July, and then reappeared in a very virulent form, following a heavy rainfall. A peculiar feature was that the fungus was then able severely to attack the ripening grapes which developed a typical brown rot. This belated outbreak of the mildew, after a prolonged state of apparent dormancy [which the author terms diapause], is attributed to the survival of the mycelium of the fungus in the host tissues, the severity of attack being probably due to an intensification of virulence of the organism during its latent state, since in normal years such severe outbreaks are not observed towards the end of the vegetative period and the fungus very seldom attacks the grapes.

The main inference from these observations is that dry or semi-dry conditions during the early part of vegetation are not a guarantee that the disease will not break out later in the season, on the onset of more or less wet conditions. Since such late outbreaks appear to be of a greatly intensified severity, and are capable of causing considerable damage to the ripening grapes, the vines should be sprayed with Bordeaux mixture as soon as feasible after the first belated rainfall, independently of the number of the previous applications of the fungicide.

Deckenbach (K. N.). Полисульфиды кальция и борьба с мильдью. [Calcium polysulphides and the control of mildew.]—*Materials for Mycol. and Phytopath.*, vii, 1, pp. 191–194, 1928. [Received August, 1929.]

Brief details are given of spraying experiments which were made in 1927 for the purpose of testing the efficacy under Crimean conditions of lime-sulphur sprays for the control of vine mildew [*Plasmopara viticola*]. The tests were carried out in three commercial vineyards in the neighbourhood of Balaclava, which had suffered severely from the disease in 1926 and in the few immediately preceding years. The results showed that the plots which had received, according to the local weather conditions, two or three applications of the spray, stood out prominently in September by their green and healthy foliage from among the surrounding plots that had been sprayed four times with 1·5 per cent. Bordeaux mixture. The success of the experiment is chiefly ascribed to the great care that was taken in thoroughly wetting the under surface of the leaves all over the vinestocks, and to the fact that, following the indications of the meteorological station, the second and third sprays were applied one or two days before a predicted heavy rainfall. The concentration of the spray recommended is a 1 in 50 dilution of lime-sulphur at 28° Baumé for the first and a 1 in 60 dilution of the preparation at 32° B. for the subsequent applications.

BIRON (M.). **Il faut 'poudrer'!** [Dust!]—*Prog Agric. et Vitic.*, xci, 24, pp. 570–572, 1929.

After pointing out the convenience attaching to the use of dusts as compared with fluids for the treatment of vines against mildew [*Plasmopara viticola*], especially as regards their preparation and handling, the author states that even in windy weather the fruit clusters can be better covered by the former. In his opinion, the first two treatments should consist of a liquid spray (2 kg. copper sulphate, 150 gm. copper arsenite, and 3 kg. lime, per hl. water), while subsequent applications should take the form of cupric mixtures (without arsenic) or, preferably, of very fine, adhesive cupric dusts, to which an insecticide may advantageously be added.

[This paper also appears in *Rev. de Vitic.*, lxxi, 1829, pp. 41–43, 1929.]

SAHUT (H.). **Comment défendre nos Vignes contre l'Oïdium.** [How to defend our Vines against *Oidium*.]—*Prog. Agric. et Vitic.*, xci, 23, pp. 553–554, 1929.

The author states that sulphur dusts have been used for nearly a century in France for the control of vine *Oidium* (*O. tuckeri*) [*Uncinula necator*], three applications being usually given, viz., when the young shoots have attained a few centimetres in length, at flowering time, and shortly before the berries turn green. In some localities ground sulphur is in general use, but in others most growers prefer the sublimed form. It is agreed by most experts that the efficacy of any kind of sulphur used to control *U. necator* depends on the proportion of pure sulphur it contains, its fineness, lightness, and readiness to become oxidized [cf. *R.A.M.*, viii, p. 701]. Sublimed sulphur is slightly purer than the ground form (containing 99·5 as compared with 98 per cent. sulphur) and can be obtained in a dust so fine as to pass through a 120-mesh sieve. Also, the sublimed sulphur is much the lighter, 100 kg. being as effective as 135 kg. of ground sulphur (100-mesh), while as the former costs only some 20 fr. more per 100 kg. than the ground sulphur it is also the more economical. Further, as the sublimed sulphur is composed of ovoid utricles arranged in thin, loose chains and consisting of a crystalline nucleus surrounded by an amorphous envelope which oxidizes very readily, it is definitely more efficacious than ground sulphur.

WOOD (J. G.). **Physiological derangements in Vines subsequent to injury by cold.**—*Australian Journ. Exper. Biol. and Med. Sci.*, vi, 2, pp. 103–106, 1 pl., 1929.

Particulars are given of the damage caused to currant and sultana vines in the Murray Valley, South Australia, by the 'black frost' of September, 1927 (when 8° to 12° F. of frost were recorded), and of the subsequent physiological derangements in the affected individuals.

A microscopic examination of the injured tissues of the young green shoots showed a breakdown of the parenchyma cells of the cortex, the medullary rays, and the pith, followed by torsion and laceration of the wood elements. The cambium of the stems also underwent degeneration, the protoplasm of the cells becoming

brown, due to the formation of oxidized phenolic compounds, and the cell walls breaking [cf. *R.A.M.*, viii, p. 78].

On the resumption of respiration after the temporary paralysis of cell activity, metabolic disturbances occurred in connexion with the hydroxy-aromatic compounds, causing the shedding of the inflorescences produced from dormant buds on wood or canes only slightly injured by the cold. Sections of the axis at this stage revealed no abnormality of the tissues except those of the cambium, which were beginning to turn brown and were found to contain tannin. Black spots or streaks then developed locally on the main axis and spread rapidly until the whole inflorescence was dead and black. There were no signs of insect or fungous invasion, and the symptoms must therefore be attributed exclusively to metabolic derangements.

The development of tannin in the cambium was found to be followed by intense metabolic activity, in which the pericycle formed large amounts of tannin. The cells of the medullary rays, and the layer of pith cells adjoining the xylem tracheids, behaved in a similar way. All these cells later degenerate and die, so that the whole of the vascular tissue is isolated from the rest of the living tissues. The death of the flower buds is due to the fact that the sap cannot reach them. The cutinization of certain pith cells near the affected regions protects the living cells of the pith from further degeneration, but simultaneously cuts them off from the vascular elements, so that they, too, gradually die.

Plantesygdomme i Danmark 1928. Oversigt, samlet ved Statens plantepatologiske Forsøg. [Plant diseases in Denmark in 1928. Survey of data collected by the State Phytopathological Experiment Station.]—*Tidsskr. for Planteavl*, xxxv, 3, pp. 420–471, 7 figs., 2 graphs, 1929. [English summary.]

Among the many items of interest in this report on Danish plant diseases, based partly on the monthly surveys issued by the Station and partly on material submitted for inspection, as well as on personal observations [cf. *R.A.M.*, viii, p. 151], the following may be mentioned. Yellow tip [reclamation disease] was prevalent on oats in Jutland, where it was also observed to a lesser extent on barley and occasionally on wheat. In some cases there were no marked symptoms on the leaves but the ears were empty; the condition of the plants was improved by applications of copper sulphate [ibid., vii, p. 396; viii, p. 303]. The beneficial after-effects of the copper sulphate contained in the Bordeaux mixture used for spraying potatoes were noticeable in the succeeding oat crop. In one instance the effects of copper sulphate applied to oats in 1925 were still apparent in 1928, when the yield of the barley crop in the treated plots was nearly three times as high as in the controls.

Bright speck [grey speck: ibid., vii, p. 397; viii, p. 151] was prevalent and severe on oats; the Borris variety was resistant. The disease also occurred on fodder and sugar beets and potatoes, the yield of which was augmented by the application of manganese sulphate. Strawberries in a nursery at Farum were affected by a

similar condition, manifested by yellow heart leaves, poorly developed inflorescences, and stunted growth. The soil reaction in the diseased plots was P_H 8 to 8·3, compared with 7·5 to 7·9 in the healthy ones. Similar reports were received from other localities. Roses also showed symptoms of bright speck in acid soil.

Dry rot of swedes (*Phoma napobrassicae*) [*P. lingam*: ibid., viii, p. 691] is becoming increasingly prominent, the Bangholm Lyngby VI variety being most severely attacked in 1928, while Wilhelmsburger and Studsgaard Bangholm were resistant. Infection has been proved at Lyngby to be transmitted by the seed and to be carried from diseased to healthy plants by the wind. Soil infection, though not definitely proved, is considered to be highly probable.

Beets at two localities in Funen were attacked by a disease resembling 'tuberculosis' (*Bacterium beticola*) [ibid., viii, p. 541]. In the same province and also in Lolland and Falster, both sugar and fodder beets were affected by a form of leaf curl apparently distinct from those known in Central Europe and the United States.

Potato wart (*Synchytrium endobioticum*) was recorded for the first time from the Faroe Islands.

The best control of potato blight [*Phytophthora infestans*] was given by Bordeaux mixture, but cupryl dust (J. Hansen, Amaliegade 36, Copenhagen) and Niagara Bordeaux dust (C. Rex, V. Voldgade 14, Copenhagen), both applied at the rate of 200 kg. per hect., gave increased yields of 69 and 72 hectokg. per hect., respectively.

The Marlborough, Superlative, Fajstrup resistant, Asker, Non Plus Ultra, Summit of Perfection, and other raspberry varieties have been found susceptible to anthracnose (*Plectodiscella veneta*), which is very prevalent but seldom severe in Denmark.

The following diseases are reported for the first time in the country. Gloire de Lorraine begonias suffered in 1927 and 1928 from a bacterial disease characterized by the occurrence of pale spots near the leaf edges, which ultimately wilted. Cinerarias were attacked by *Ascochyta cinerariae*; *Viola tricolor* by a species of *Cercospora* having spores with a long, hyaline appendage; azaleas by wilt disease (*Ramularia* sp.) [ibid., vii, p. 640; viii, p. 630]; gladioli by *Sclerotium gladioli* [ibid., vii, p. 724]; *Narcissus pseudonarcissus* by *Fusarium* sp., causing a chocolate-brown discoloration of the bulb scales [ibid., viii, pp. 42, 382, 383]; willows [*Salix* spp.] by *Gloeosporium* (?) *beckianum*, causing blackening of the shoots; and lucerne by *Titaea maxilliformis* in association with *Typhula trifolii* [ibid., vii, p. 450] or *Fusarium*.

Red currants showed symptoms of reversion under conditions indicating that the disease had spread from black currants [ibid., viii, p. 152]; *Ribes sanguinea* was also affected.

Spraying injury to apple trees is a serious problem. Experiments have shown that the damage may be minimized (without reducing the efficacy of the treatment in the control of scab [*Venturia inaequalis*]) by applying lime-sulphur (2 in 100) before flowering and 'white' Bordeaux (0·5–1–100) afterwards [cf. ibid., v, p. 559].

Oversigt over Plantesygdomme. 166. August, 1929. [Survey of plant diseases. 166. August, 1929.]—*Statens plantepatologiske Forsøg*, 7 pp., 2 pl., 1929.

In the section of this report dealing with cereals and root crops, E. Gram reports the occurrence of severe attacks of foot rot (*Ophiobolus graminis* and *Fusarium culmorum*) on oats following barley in Jutland [*R.A.M.*, vii, p. 222].

Dry rot of beets (*Phoma betae*) was observed in the Aalborg district on the same plots in which oats were affected by bright [grey] speck [see preceding abstract].

Mention is made, in the section on fruit and vegetable diseases, of reversion of red currants [loc. cit.]. The affected bushes are vigorous but have borne no fruit for several years. In Lolland and Falster the infection of currants by *Cronartium ribicola* appears to be steadily increasing in localities where there are no pine trees in the immediate vicinity. Red and black currants and gooseberries have been widely attacked by *Gloeosporium ribis* [*Pseudopeziza ribis*: ibid., vii, p. 223], to which the Red Spanish currant is reported to be resistant. In one district the disease was particularly severe on black currants in dry sandy soil.

KERN (H.). **Hungary: important or new plant diseases observed during 1926–1928.**—*Internat. Bull. of Plant Protect.*, iii, 6, pp. 82–83, 1929.

Notwithstanding systematic crop rotation, take-all of cereals (*Ophiobolus graminis* and *O. herpotrichus*) [*R.A.M.*, viii, p. 437] caused heavier losses in Hungary in 1927–8 than in 1926. Recent observations denote that the wet weather and late spring frosts are partially responsible for the spread of the disease.

Sugar beet grown in succession to lucerne destroyed by *Rhizoctonia violacea* [*R. crocorum*: ibid., viii, p. 449] contracted the disease in a serious form [ibid., vii, pp. 613, 618].

Hungary is still apparently free from potato wart (*Synchytrium endobioticum*) [ibid., vi, p. 192], but extensive damage is caused by *Phytophthora infestans*, the losses from which were estimated at 4 to 5 million quintals in 1926.

Several diseases previously of slight importance have become more widespread of recent years. Thus, *Marssonina panattoniana* destroyed the leaves and peduncles of lettuces [ibid., viii, p. 479, and next abstract], completely preventing the cultivation of this crop on one large estate. Furthermore, several diseases hitherto unknown in Hungary have been reported. Wheat on flooded land was entirely destroyed by *Bacillus cerealium* [ibid., iv, p. 738]. Lucerne was attacked by *Pleosphaerulina briosiana* [ibid., vi, p. 272] and *Gloeosporium morianum*. Downy mildew of hops (*Pseudoperonospora humuli*), reported for the first time in 1926 [ibid., vi, p. 691], has spread over almost the whole country; effective control, however, has been given by spraying with Bordeaux mixture. Other diseases new to Hungary are caused by *Bacillus sorghi* on *Sorghum vulgare* [*Andropogon sorghum*: ibid., v, p. 208], *Bacterium phaseoli* on beans [*Phaseolus vulgaris*], and *Alternaria* on apples.

Bericht der Lehr- und Forschungsanstalt für Wein-, Obst- und Gartenbau zu Geisenheim a. Rh. für das Rechnungsjahr 1928. [Report of the Viticultural, Pomicultural, and Horticultural College and Research Institute at Geisenheim a. Rh. for the financial year 1928.]—*Landw. Jahrb.*, lxix, Supplement, pp. 87–175, 6 figs., 1929.

This report, prepared on similar lines to those of previous years [*R.A.M.*, viii, p. 14], contains numerous references of phytopathological interest, of which the following may be mentioned.

A sclerotial disease, of which the causal organism was not exactly determined, affected several *Lilium candidum* plantings at Frankfurt. The stems, which bore longitudinal fissures, drooped and rotted; their tissues were found to contain mycelium and numerous black sclerotia.

Lettuces received from Hungary were found to be infected by *Marssonina panattoniana* [see preceding abstract], which is so virulent in that country as to threaten the destruction of seed-bearers in certain seasons. The leaves and veins showed small, yellowish spots bearing the bicellular, hyaline spores of the fungus.

Phoma enteroleuca was isolated from cankers on a young shoot of a standard apple tree. The cortex and wood underlying the affected area were discoloured and dead.

Fusicladium [*Venturia pirina*] was generally unimportant on pear trees during 1928, but nevertheless Hardenpont's Winter Butter, Diel's Butter, Esperens Bergamotte, Notaire Lepin, and Gräfin von Paris showed severe storage injury from this cause towards the beginning of December. This shows the necessity for a late summer spraying with the onset of damp weather.

The incidence of 'mauke' [*Bacterium tumefaciens*] on grafted vines [ibid., vii, p. 622], which had decreased considerably in 1927, rose to such an extent in 1928 that the existence of the stands was endangered in certain vineyards, especially in the Upper Moselle valley. The cankers extended right round the stocks of 80 per cent. of the two- to three-year-old vines in one district, resulting in complete loss where excision and the application of dendrin were omitted. Presumably this marked increase of infection was correlated with the hard winter frosts of 1927–8, which were followed by similar conditions in May. In addition to 50 or 100 per cent. dendrin, the application of 100 per cent. florium to the infected stocks gave promising results.

Jahresbericht der Preussischen Landwirtschaftlichen Versuchs- und Forschungsanstalten in Landsberg a. d. Warthe. Jahrgang 1928–29. [Annual Report of the Prussian Agricultural Experimental and Research Institutes at Landsberg a. d. Warthe. Year 1928–29.]—*Landw. Jahrb.*, lxix, Supplement, pp. 177–319, 10 figs., 1929.

This report contains, *inter alia*, the following items of interest [cf. *R.A.M.*, vii, p. 15]. In a series of experiments in the control of wheat bunt [*Tilletia caries* and *T. foetens*], *Fusarium* of rye [*Calonectria graminicola*], barley stripe [*Helminthosporium gramineum*], and loose smut of oats [*Ustilago avenae*] with a

number of commercial seed disinfectants, the first-named disease was reduced to a minimum by Sch. 779, manufactured by I. G. Farbenindustrie, Höchst U. (100 gm. in 1·5 l. water per 50 kg.) and Sch. 1362 and 1364 (Meyer, Mainz) at the rate of 2 l. of a 2 or 2·5 solution or 1·5 l. of a 3 per cent. solution per 50 kg. of seed-grain. The best control of *C. graminicola* was given by abavit B 1286 and 1097, the former at the rate of 50 and the latter at that of 100 gm. in 1·5 l. of water per 50 kg.; the incidence of infection was reduced from 41·2 to 7·7 and 9 per cent., respectively. The same preparations were effective against stripe disease, which was further controlled by dusting with U.T. 871 and 875 (I. G. Farbenindustrie, Leverkusen) at the rate of 100 or 150 gm. per kg., and by the use of Sch. 833, applied either as a dust (150 or 200 gm. per kg.) or at the rate of 150 or 200 gm. in 0·3 l. water. Dusting with U.T. 871 also completely controlled loose smut of oats, while U.T. 875, Sch. 1364 at the rate of 3 l. of a 2·5 or 3 per cent. solution per 50 kg., Sch. 833 (200 gm. in 0·3 l. water), and 30 minutes' immersion in 0·25 per cent. G. 533 (I. G. Farbenind., Wolfen) were almost equally efficacious.

Vacuolate bodies, a dirty reddish-purple with safranin haemalum, occur (usually close to the nucleus) in the cells of mosaic potato tissues. On the basis of the nuclear changes observed [which are described], the theory is advanced that the characteristic mosaic structure (low palisade and densely woven spongy parenchyma) is due to a disease of the nucleus manifested by metabolic disturbances. A chemical analysis of mosaic and healthy tubers showed that the former possessed a higher total nitrogen content than the latter. The form of leaf roll associated with growth in acid soils [ibid., vii, p. 461] was found to be transmissible to the progeny of affected Odenwälder Blaue, Deodara, and Parnassia plants transferred to slightly alkaline soils.

The following potato varieties [in addition to those previously mentioned] are reported to be immune from wart disease [*Synchytrium endobioticum*]: Kaiserkrone, Lichtblick, Berlichingen, Maibutter, Seydlitz, Weltwunder, Glückauf, Palma, Beseler, Franz, Roon, and Wallenstein. Most of these were also resistant to leaf roll in a series of varietal tests [the results of which are tabulated].

Good control of potato blight (*Phytophthora infestans*) was given by cupulvit (Meyer, Mainz) and L. 122 (prepared at the Station), both of which were found practically equal to the 2 per cent. Bordeaux mixture.

The Strube's Z variety of sugar beet again proved most resistant to root rot [*Phoma betae*, *Pythium de Baryanum*, and *Aphanomyces levis*] (5·4 per cent. infection compared with 10·2 per cent. in Knoche's E).

Trabajos de las Estaciones de Fitopatología Agrícola en el año 1928. [Work of the Stations of Agricultural Phytopathology in the year 1928.]—*Bol. Pat. Veg. y Ent. Agric.*, iii, 12–14, pp. 179–204, 1928. [Received September, 1929.]

Lists are given of the principal plant diseases observed at the Spanish Phytopathological Stations during 1928 [cf. *R.A.M.*, viii,

p. 152]. Chillis in Valencia were attacked by a species of *Oidiopsis* which caused considerable damage [cf. ibid., vii, p. 675].

HANSFORD (C. G.). **Annual Report of the Government Mycologist.**—*Ann. Rept. Uganda Dept. of Agric. for the year ended 31st December, 1928*, pp. 46–47, 1929.

Sporadic occurrences of root disease of coffee (*Macrophomina phaseoli*) [*R.A.M.*, vii, p. 701] were reported from all the plantations. The same fungus caused heavy damage to beans [*Phaseolus vulgaris*] at Serere [ibid., viii, p. 634].

Cotton in the Teso district was heavily infected by the black arm form of angular leaf spot [*Bacterium malvacearum*: ibid., viii, pp. 306, 307], which appears to be dependent in Uganda on climatic and possibly soil conditions, and in this case was associated with an abnormally wet season [ibid., viii, p. 702]. Eleven strains of *M. phaseoli* and one of *Rhizoctonia* [*Corticium*] *solani* were tested for pathogenicity to cotton and *Vigna sinensis* seedlings. Those inoculated with *C. solani* succumbed to sore shin [ibid., viii, p. 570], while no injury was caused by *M. phaseoli* during a period of two to three months. *Nematospora gossypii* was found inside seeds of *Hibiscus cannabinus* and *H. esculentus* previously infested with *Dysdercus* [ibid., vii, p. 702; viii, p. 717].

Mosaic of sugar-cane was very prevalent in a mild form on the estate showing infection in 1927 [ibid., vii, p. 703], but there is every indication that the spread of this disease can be arrested by thorough roguing.

A serious tea disease, characterized by sudden wilting of the foliage and by longitudinal cracks in the bark extending down below soil level and involving one or more roots, was observed on one estate. The cracks were found to contain rhizomorphs of *Armillaria* sp. [ibid., viii, p. 469], which also extended from the roots into the soil. The construction of isolation trenches and the destruction of all infected trees were recommended.

Black shank disease of tobacco (*Phytophthora nicotianae*) [ibid., viii, p. 470] again caused damage to imported varieties, but its known distribution is still restricted to the Government plantations at Kampala and Serere.

Streak disease of maize, carried by *Balclutha mbila* [ibid., vii, p. 439; viii, p. 403], occurred at Bukalasa and Kampala, while Dr. Storey also found it on *Digitaria* during his visit to Uganda.

Forty-seventh Annual Report of the Ohio Experiment Station for 1927–28.—*Ohio Agric. Exper. Stat. Bull.* 431, 180 pp., 22 figs., 3 maps, 1928.

In the section of this report dealing with plant pathology (pp. 51–68) a brief account is given of studies made on the chemistry of the toxic factor of sulphur as tested on spore germination [*R.A.M.*, viii, p. 390]. An investigation of the adhesiveness of various [named] sulphur dusts [the results of which are tabulated] showed that even after light showers very little sulphur remained on the leaves; laboratory and field tests indicated that at least 0·3 mg. of sulphur per sq. in. must remain to secure control. When dusts are applied at the rates usually recommended, the

application is approximately 2·5 mg. per in. of leaf; if 80 to 90 per cent. of this is washed off by rain only 0·2 mg. per sq. in. remains (mostly along the veins), an amount which is scarcely adequate to afford protection.

The results obtained after four years' work by the apple scab spray service organized by the Ohio Agricultural Experiment Station show that growers by following the spray schedule as modified according to the weather conditions can obtain almost complete control of *V. inaequalis*; in 1928, 27 growers in one county who followed the service schedule exactly had over 90 per cent. clean fruit, whereas others who followed a set schedule had only 74 per cent. The spray service is being extended to many other fruit diseases.

In a field experiment with potatoes, in which copper-lime dust was applied either when the plants were wet with dew in the morning, or later in the day when they were dry, it was found that the latter gave an increased crop of only 18·4 bushels per acre, while the former gave 37·6. When the dust is applied to dry leaves the carbon dioxide of the air reacts with the calcium hydroxide of the dust to form insoluble calcium carbonate which cannot react with the copper sulphate when moisture is supplied, to form the adhesive Bordeaux-like compounds; if much of the calcium hydroxide has carbonated, insufficient remains to neutralize the copper and the free copper may burn the leaves. When potato plants were dusted with hydrated lime, and the amount of active calcium hydroxide was determined at intervals, it was found that this rapidly fell from 74·9 per cent. immediately after dusting until after 24 hours it had completely disappeared.

By the use of a potentiometer, galvanometer, and a thermocouple it was found that a coating of Bordeaux spray reduced the internal temperature of potato leaves in a greenhouse in March by an average of 2·5° F., though this difference did not hold in cloudy weather.

Copper dust mixtures in which part of the lime usually present in a 20–80 monhydrated copper sulphate-hydrated lime dust was replaced by kaolin or infusorial earth, in order to improve the flowing or adhesive qualities of the mixture, were tested on celery blights [*Cercospora apii* and *Septoria apii*]. The results obtained showed that none of these mixtures was as good as those containing the full amount of lime. When copper sulphate crystals were used instead of monohydrate copper sulphate, control was unsatisfactory.

Experiments in seed treatment for the control of root rot of maize [ibid., vii, p. 778] conducted during a period of three years did not result in increased yields or control of the disease.

In studies of tomato leaf mould (*Cladosporium fulvum*) preliminary tests with experimental humidity chambers indicated that with a very rapid change of air (more than once each 30 seconds) a relative humidity of 85 to 90 per cent. may be tolerated without infection. With less frequent air changes the humidity may have to be maintained below 80, while any installation that changes the air less often than once in three minutes is inadequate. An adequate heating device by which air taken in from outside the house may

be warmed before it is blown over the plants is a necessary part of any good ventilating system for greenhouses [ibid., vii, p. 749].

Almost complete control of oat smuts [*Ustilago avenae* and *U. kolleri*] was secured with from 4 to 8 per cent. formaldehyde dust [ibid., viii, p. 24] applied overnight. The stronger concentrations caused some seed injury and it is recommended to use 4 or 5 per cent. dust at the rate of 3 oz. per bushel.

PETERSON (W.). **Biennial Report of Director, July 1, 1926–June 30, 1928.**—*Utah Agric. Exper. Stat. Bull.* 209, 83 pp., 1929.

This report contains several references of phytopathological interest in addition to those already noticed from other sources. Among the new diseases observed in Utah during 1927 were psyllid yellows of potato [associated with potato psylla *Paratrioza cockerelli*: *R.A.M.*, viii, p. 633], bacterial leaf blight of privet [*Ligustrum vulgare*], leaf spot (*Ovularia pulchella*) of red top [*Agrostis vulgaris*], leaf spot (*Cylindrosporium shepherdiae*) of buffalo berry [*Shepherdia argentea*], and bacterial leaf blight of strawberry [ibid., vii, p. 620].

The incidence of the *Fusarium* wilt of tomato (*F. lycopersici*) appears to be increasing in the State, and the *Verticillium* wilt of this crop was also found on varieties grown for canning. The latter fungus severely attacked eggplants in Salt Lake Country in 1926. A survey of the tomato fields of Davis and Weber Counties in 1926 showed that streak [ibid., vii, p. 605] was gaining ground and causing heavy losses (up to 65 per cent. reduction of the crop).

Heart rot of celery [cf. ibid., vii, p. 218], which has completely ruined the crop in a number of fields, is characterized by a blackening of the hearts followed by definite rotting of bacterial origin. The trouble is attributed to excessive irrigation.

BOEHM (M. M.) & KOPACZEWSKI (W.). **Études sur les phénomènes électrocapillaires. IX. L'antagonisme microbien et la thérapeutique du cancer.** [Studies on electrocapillary phenomena. IX. Microbial antagonism and cancer therapy.]—*Protoplasma*, vi, pp. 302–320, 1 col. pl., 1 fig., 1929. [Abs. in *Bot. Centralbl.*, N.F., xv, 5–6, p. 139, 1929.]

The biological antagonism existing between *Bacillus* [*Bacterium*] *tumefaciens* and *Streptococcus erysipelatus* causes the retardation or even suppression of tumour formation in *Pelargonium* by the former organism [*R.A.M.*, viii, p. 430] when the latter is inoculated into the same plant. The mutual antagonism between the organisms was further exhibited in all the culture media used (bouillon, tomato juice, and horse serum). A similar relation was observed between *Bact. tumefaciens* and *Bacillus prodigiosus* in respect of actual acidity. In connexion with these investigations it was found that the mechanism of the action of *Bact. tumefaciens* is not identical in plant and animal tumours.

POTENZA (G.). **Osservazioni su la recettività dei cereali per la ruggine.** [Observations on the susceptibility of cereals to rust.]—*Staz. Agrar. Sperim. Bari Pubb.* 12, 72 pp., 12 figs., 1928. [Received July, 1929.]

After reviewing the results obtained in various countries from investigations into the relations between weather conditions and rust infection (*Puccinia* spp.) of cereals [cf. *R.A.M.*, ii, p. 361; iii, pp. 130, 387; iv, p. 658; vi, pp. 346, 539; viii, p. 364], and pointing out that this question has not hitherto received attention in Italy, the author gives a fully detailed account of his researches into this and cognate problems made under the hot, dry climatic conditions of Apulia, during the seasons 1925–7.

Rust infection generally was light in 1925, more severe in the year following, and reached epidemic proportions in 1927. More rain fell during the autumn and winter of 1924–5 than in either of the subsequent two winters, while 1926–7 was very dry. During flowering the weather was wetter in 1926 and drier in 1927 than in 1925, while during ripening it was drier both in 1926 and 1927 than in 1925.

In 1925 the first attack of yellow rust (*P. glumarum*) was noted on Florence wheat on 26th March, the attack becoming general on all varieties on 22nd April. In 1926 the initial onset took place on Dauno (Strampelli) and Semiaristato 48 (Todaro) wheats on 15th March, the attack becoming general between 9th and 20th April. In 1927 the first attack occurred on Varrone and Dauno VI varieties on 31st March, becoming general from 7th April.

Allowing six to eight days for incubation, the first infection of *P. glumarum* in 1925 probably took place on 20th March, following two days of heavy rain (44·8 mm.); from this date until the full development of the first pustules on Florence wheat the nights were cold (1·8° to 4° C.) except on 2nd March, when the minimum temperature rose to 8·2° and rain fell. From 20th to 24th March the atmospheric humidity was high (minima 34 to 52 per cent.); this fell to 28 per cent. on 25th March and next day the pustules opened. During the first three days there was little sunshine, but afterwards there was over seven hours' sunshine daily.

It is concluded that infection of wheat by *P. glumarum* takes place under conditions of low atmospheric temperature, high atmospheric humidity, and a cloudy sky. Other important factors are the degree of turgescence of the leaves, the extent to which the stomata are open, and soil humidity, which in 1925 was very high.

Observations showed that the stomata of wheat leaves remain shut during the night and open at daybreak, closing again if the light becomes too strong or the air too dry. Hence, as the spores of *P. glumarum* do not germinate except in the presence of liquid water on the leaves, the period between dawn and full sunlight or the blowing of a drying wind has an important influence on infection; the longer this period lasts, the wetter and calmer the air, the greater is the likelihood of infection. Similar conclusions were drawn from the data [full details of which are given] obtained in the two following seasons. It is also stated that the cooling of the leaves favours infection, which invariably occurred on mornings when the temperature at dawn had fallen below 5°.

Uredospores of *P. glumarum* have not been found on wheat during autumn or winter in the vicinity of Bari. Temperature observations [which are given] indicated that the date of the first attack each year bears no relation to the temperature. A high temperature and plenty of sunshine, however, by favouring assimilation, increase the sugar content of the leaf, and thus make it more receptive.

The alternation of hot, calm days with cold, windless nights makes the leaves receptive, while it also allows dew to remain on the open stomata at dawn. An indispensable condition for infection is a high soil humidity, which keeps the plants fully turgescent.

In 1925 the maturation of the pustules of stem rust (*P. graminis*) on the top internode of the culm was first observed on Florence, Gentilrosso Passerini, and Romanello 187 Todaro wheats on 30th May, when the glumes of these varieties were beginning to turn yellow. In 1926 the first mature pustules were observed on 12th May on Civitella and Rosso Canavese Todaro wheats, and on 18th May on Varrone Strampelli, when the top internode of these varieties had not yet completely emerged from the sheath. In 1927 all varieties were infected practically simultaneously on 25th May.

Allowing time for the maturation of the sori, the first attack of this rust in 1925 occurred not before 22nd May, when the temperature at 2 a.m. was 4·5° and at dawn was 6°. In the previous five days the minimum temperature never fell below 10°; atmospheric humidity was high and the wind light. Similar observations were made in the two subsequent years, and it is deduced that the indispensable condition for attack by *P. graminis* is also the presence of liquid water on the host while the stomata are open. Marked cooling of the leaves does not appear to be a factor. A drop in the temperature from 27° to 10° in May is relatively of the same biological importance as one of from 17° to 0° in March. The average temperature for the month preceding infection by *P. graminis* does not appear directly to affect the date of the attack, but it is probable that an early first infection favours the dissemination of the uredospores in the field. No direct relation was established between soil humidity and the date of the first infection by *P. graminis*, but the figures indicated that a reduction in soil humidity favours infection.

The total effect of *P. graminis* on the host may be estimated by the degree of constriction in the inflorescence. This is commonly attributed by growers to the drying up of the ears owing to heat, but it is largely due to the mycelium of the fungus; the amount of constriction is not in proportion to the severity of infection but it increases as the atmospheric temperature rises. The mycelium intercepts the passage of nutrient material from the stalk to the ear, aggravates the condition set up by the excessive transpiration of the living tissues of the inflorescence, and impedes the formation of starch in the grain.

Further observations [the data being fully given] showed that infection of oats by crown rust (*P. lolii*) is favoured by days with heavy dew and low temperature at daybreak and a high soil humidity, provided that the plants have already appeared above the ground. Climatic conditions determine the date of the first

attack of *P. lolii* in so far as they hasten vegetation; specific resistance being taken into consideration, oats sown earliest are the first to be attacked.

Experiments with various chemical fertilizers showed that (apart from specific resistance) unmanured oats were attacked earlier by *P. lolii* than were manured plants, but the former bore numerous small pustules, whereas those on the latter were long and broad. Infection is more severe the later the supply of soluble nitrogen becomes available. In a comparative test three plots treated with ammonium sulphonitrate, the same plus phosphorite, and sodium nitrate plus superphosphate showed, respectively, 40·3, 22·2, and 6·7 per cent. infection.

Surface irrigation increased the amount both of *P. glumarum* and *P. graminis*, whereas sub-irrigation had no effect on the former and increased the resistance of the plants to the latter, possibly because in the locality concerned infection by *P. graminis* is associated with moist air and a dry soil.

Both *P. glumarum* and *P. lolii* are more severe as growth is more rapid, but with *P. graminis* the reverse holds, due allowance being made for the specific susceptibility of the race since the total infection depends on both factors.

The author's observations indicate that the susceptibility of each variety and each pure race may vary from one year to another in the same locality.

While a parallel may exist between the constriction of the inflorescences caused by *P. graminis* and that produced by drought, the two may be unrelated and should therefore be considered separately in estimating the behaviour of pure races. To this end observations should be repeated for several years at the same place.

A long bibliography is appended.

RIVERA (V.) & CORNELI (E.). **Ricerche sullo sviluppo delle ruggini sul Frumento in agro di Perugia.** [Researches on the development of Wheat rusts in the vicinity of Perugia.]—*Ann. di Tecnica Agraria*, i–ii, 5, pp. 545–588, 2 maps, 1929.

In the St. Costanzo and Vasalina districts near Perugia the areas where epidemics of wheat rusts (*Puccinia graminis, P. glumarum*, and *P. triticina*) are usually severe are clearly marked off from other areas where infection is usually light. Heavy attacks are much commoner on low-lying districts with fine argillaceous soil than on the hilltops where the soil is coarser. Wet shady places and localities in the hollows of valleys favour infection, but on the banks of the Tiber the disease is less severe than it is in places farther from the banks, this being attributed partly to the fact that atmospheric humidity is usually greatest at some little distance from a large river and not in immediate proximity to it, and partly to the effect a river has in cooling the air over its banks and so reducing the risk of fungal attack in its vicinity.

During 1928, owing, it is thought, to the unusual weather which prevailed and which was very unfavourable on the whole to the rusts, certain of the wheats grown in Perugia showed a quite abnormal rust reaction; Rieti II, for example, which is usually highly resistant, was severely affected, while Noah, which is usually

susceptible, was only slightly attacked. The worst attacks were recorded on Stamura, Carlottina bianca, Carlottina rossa, S. Michele, and Goito, while Gentil rosso 48, Inallettabile Vilmorin, Francesco, Palestro, Edda, Cervaro, Luigia, Polonico, Realforte, Germanello, Fucense duro 4 and 3 were also severely affected.

The first attack of *P. glumarum* was observed on 29th April and of *P. graminis* on 14th May, *P. triticina* being observed somewhat later.

In all cases, plants growing at the edges of the fields were attacked first, from which it is concluded that overwintering in the uredospore stage took place on volunteer cereals in adjacent areas. *Berberis vulgaris* bushes in the vicinity of the wheat fields were not attacked by *P. graminis* and the teleutospores produced on the wheat could not be germinated.

The weather conditions which prevailed at the time of the first onset of rust, in one of the few fields where infection attained epidemic proportions, were marked by light rain following very hot weather on 27th to 31st May, which was preceded by a cool, rainy period from 15th to 26th May [see preceding abstract].

The sharp rise in temperature on 27th May, following rain, predisposed the wheat to infection, while the shower which fell on 1st June favoured the germination of the spores and their penetration into the host tissues, which were then in a susceptible condition; the formation of sori and the production of uredospores took place during the hot, dry spell.

Roussakoff (L. F.). **Опыт группировки озимых пшениц по пораженности их бурой ржавчиной.** [An attempt to classify winter-sown Wheats according to the degree of their infection with brown rust.]—*Morbi Plantarum*, Leningrad, xviii, 1–2, pp. 54–65, 1929. [German summary.]

Brown rust (*Puccinia triticina*) did not overwinter in 1926–7 on the winter sown wheats in the region of Eysk [north Caucasus], a fact which is attributed to sharp fluctuations of temperature and the total absence of a snow cover, owing to which the wheat stands appeared considerably thinned out in the early spring, with all their autumn formed leaves dead. The first pustules of the rust appeared towards the middle of May, the character of the infection, which was very slight and very evenly distributed over the fields, as well as the size of the pustules, indicating that the infecting spores had been brought by air currents from neighbouring districts, where the rust was very prevalent. From the middle of May to the 23rd June the weather remained dry, with only a few slight morning dews, in spite of which the rust was able to develop a fairly high degree of intensity, thus demonstrating the drought resistance of the fungus. It was noticeable, however, that the intensity of the rust was much less in the Eysk district than in other regions of north Caucasus, where rains had been more frequent and more abundant.

These exceptional weather conditions allowed the author to make an attempt to classify the winter sown wheats tested at the Eysk Agricultural Experiment Station according to their degree of infection with the rust. From the first it was noted that all early

maturing varieties, with a few exceptions, suffered much less from the rust than the later ripening, independently of the date of sowing. A closer examination permitted of subdividing the varieties [which are named] into five groups on the ground of their relative resistance. The most resistant were *Triticum nigroaristatum* 392, *T. erythrospermum* 3251, Ukrainka, Stepnyatschka, and some local selected varieties, which are considered to present a favourable material for breeding for resistance to brown rust.

It is pointed out that in estimating the rust resistance of a given variety account must be taken of all factors that may advance or retard the date of maturation of the wheat.

Roussakoff (L. F.). Ржавчина хлебов на Ейской Сельско-Хозяйственной Опытной Станции в **1927** году. [Cereal rusts at the Eysk Agricultural Experiment Station in 1927.]—*Plant Protection* (formerly *La Défense des Plantes*), Leningrad, vi, 1–2, pp. 103–127, 1 fig., 1929.

In this paper notes are given on the development in 1927 of the principal cereal rusts in the region of Eysk [north Caucasus], where brown rust (*Puccinia triticina*) of wheat is stated to be of the greatest economic importance. As stated in a previous communication [see preceding abstract] this rust failed to overwinter on autumn sown wheats which suffered considerably during the winter from climatic conditions, all the autumn formed leaves of the survivors being quite dead and dry in the early spring of 1927. The rust first appeared in the middle of May simultaneously on winter and spring wheats, the infection having been obviously brought by winds from outside areas, where the rust had successfully overwintered. Observations made by means of aeroscopes [*R.A.M.*, vii, p. 234] showed that a large proportion of the *P. triticina* spores were carried from 50 to 250 km. over the sea without losing their infectivity. Autumn sown rye, on the other hand, came through the winter with much less damage, some of the autumn leaves being still partially green in the spring and bearing a few pustules of brown rust (*P. dispersa*) [*P. secalina*], which renewed the infection much earlier than in the case of wheat, about 10 per cent. of the rye plants being already rusted by the middle of May. These facts show the close dependence of the spring renewal of the rusts on the survival of autumn leaves through the winter.

Yellow rust (*P. glumarum*) of wheat appeared some four weeks after the brown rust and soon disappeared owing to the exceptionally dry weather. Stem rust (*P. graminis* f. *tritici*) broke out very late, and only attained an appreciable degree of development in the latest sown spring wheats. The same was true of the rye stem rust (*P. graminis* f. *secalis*). Stem rust of oats (*P. graminis* f. *avenae*) was first observed in August, several weeks after the harvest, on the new growth from the stubble. *P. simplex* [*P. anomala*] occurred to a very slight degree only on the very late maturing varieties of barley.

No definite conclusions could be arrived at from experiments in the control of wheat brown rust by dusting the plants with flowers of sulphur, as the applications were made very late in the season

and the rust was not very severe. There was some evidence, however, that the four applications made reduced the incidence and intensity of the rust to about three-fourths of those in the controls, and increased the yield by 18 per cent.

A greenhouse experiment [some details of which are given] indicated the existence of a direct relationship between the intensity of infection of wheat leaves with brown rust and the degree of their premature desiccation, as the heavier the infection the greater was the degree of desiccation.

Teterevnikova-Babayan (Mme D. N.). Наблюдения над биологическими видами **Puccinia graminis Pers.** в Детском Селе в **1926** и **1927** г. [Observations on biological races of *Puccinia graminis* Pers. at Detskoye Selo in 1926 and 1927.]—*Morbi Plantarum*, Leningrad, xvii, 1–2, pp. 35–50, 1928. [Received August, 1929.]

Further observations in the neighbourhood of Detskoye Selo, confirmed by the results of numerous cross-inoculation experiments in 1926 and 1927 [details of which are given], revealed the existence of the following hosts of the biological races of *Puccinia graminis*, in addition to those listed in the author's previous paper [*R.A.M.*, vi, p. 718], namely: for f. *avenae*—*Alopecurus geniculatus, Lolium perenne,* and *Beckmannia erucaeformis*; for f. *secalis*—*Festuca ovina, Agropyrum caninum, Hordeum jubatum, L. perenne,* and *B. erucaeformis*; for f. *phlei-pratense*—*B. erucaeformis*; for f. *tritici*—*L. perenne* and *B. erucaeformis.* A further biological form found in the region is f. *agrostis* which only attacks *Agrostis alba* and *Deschampsia caespitosa.*

Samples of *P. graminis* f. *tritici* sent from the Ural region indicated that the fungus there had the same infective properties as the Detskoye Selo strain, but that, presumably owing to climatic conditions, the infections obtained with it were lighter than with the latter.

The reactions of the different biological races on the hosts tested are given in tabular form.

Hanna (W. F.). **Nuclear association in the aecium of Puccinia graminis.**—*Nature*, cxxiv, 3120, p. 267, 1929.

The writer has recently conducted a series of experiments at the Dominion Rust Laboratory, Winnipeg, to determine the manner in which the change from the haploid to the diploid condition is effected in *Puccinia graminis* [*R.A.M.*, viii, p. 296].

The sporidia are uninucleate. In a pustule of monosporidial origin, the mycelium and the pycnospores which it produces are also uninucleate. In such a haploid pustule there appear, in the tissues near the lower epidermis of the barberry leaf, numerous sterile wefts of mycelium. These wefts, which appear crescent-shaped in transverse sections of the leaf and are composed of hyphae with uninucleate cells, are evidently haploid rudiments of aecidial cups awaiting stimulation to further developmental activity.

When nectar containing pycnospores of one sex is applied to the pycnidia of a monosporidial pustule of the opposite sex, the hyphal

wefts along the base of the pustule soon undergo a change from the haploid to the diploid condition. About 48 hours after the application of the pycnospores, the nuclei at the base of each weft become enlarged, neighbouring hyphae fuse in pairs, and two nuclei become associated in each fusion cell. These cells, initiating the diplophase, elongate and abstrict chains of binucleate cells which subsequently divide and thus form intercalary cells and aecidiospores. Sections through pustules fixed 65 hours after the application of pycnospores have shown young aecidial cups with as many as four aecidiospores in several of the chains.

The part played by the pycnospores in aecidial production is not yet completely understood. Some have been observed to germinate, and in one case the germ-tube attained a length of 15 μ. Considering that binucleate hyphae occur only at the base of the aecidium, it seems probable that the application of pycnospores of one sex to a pycnidium of the opposite one stimulates the germination of the pycnospores and the production of haploid hyphae, which grow down to the hyphal wefts near the lower epidermis and there fuse with cells of the opposite sex.

GRIFFITHS ZEHNER (MARION A.) & HUMPHREY (H. B.). **Smuts and rusts produced in cereals by hypodermic injection of inoculum.**—*Journ. Agric. Res.*, xxxviii, 11, pp. 623–627, 1 pl., 1929.

The success obtained in inoculations with maize smut (*Ustilago zeae*) [*R.A.M.*, viii, p. 562] and with sorghum loose kernel smut (*Sphacelotheca cruenta*) [ibid., iv, p. 537] by means of hypodermal injection of spore suspensions in different parts of the host plants, led the authors to investigate the possibility of using this method in infection studies of small grains with smuts and rusts. Experiments in 1927 showed that a certain percentage of barley plants of the varieties Tennessee Winter, Alaska, and Alpha developed loose smut (*U. nuda*) when a spore suspension was injected through the folded leaves into or near the apical region of growth of the tillers, while in other varieties, e. g., Hannchen and Nakano Wase. the results were either inconclusive or negative. It is believed, however, that a modification of the injection method may result in increasing the percentage of infection. Much better results were obtained in inoculation experiments on the Purplestraw, Hard Federation, Harvest Queen, and Turkey varieties of wheat with leaf rust (*Puccinia triticina*) and stem rust (*P. graminis tritici*), all the plants hypodermically inoculated with spore suspensions of these species developing abundant rust, while the plants sprayed with the suspensions all remained rust-free in the case of leaf rust and developed only a few pustules in the case of stem rust.

A brief discussion is given of the advantages presented by the injection method of inoculation, the chief of which are that it would help in keeping collections of biological forms of rusts separate, would obviate the difficulty encountered in spraying rust-inoculated plants to control mildew, and also would permit the study of the reaction to smuts of older plants, especially those of resistant varieties.

KNORR (C.). **Untersuchungen über das Verhalten von Sommerweizen-Sorten und -Bastardierungen bei künstlicher Infektion mit Steinbrand (Tilletia tritici).** [Investigations on the reaction of summer Wheat varieties and hybrids to artificial inoculation with bunt (*Tilletia tritici*).]—*Zeitschr. für Pflanzenzücht.*, xiv, 3, pp. 261–310, 2 graphs, 1929.

Full particulars [accompanied by 23 tables] are given of a series of investigations conducted over a three-year period at the Halle Agricultural and Plant Breeding Institute to determine the reaction of a number of summer wheat varieties and hybrids to inoculation with *Tilletia tritici* [*T. caries*].

It was found that all the commercial German summer wheat varieties are more or less susceptible [cf. *R.A.M.*, vii, p. 311]. The average infection in *Triticum monococcum* was 54 per cent., a result conflicting with those of Gaines (*Journ. Agric. Res.*, xxiii, p. 341, 1921) and v. Kirchner (*Zeitschr. für Pflanzenkrankh.*, xxvi, p. 17, 1916), who found this type immune. The *T. dicoccum* varieties showed a lower average of infection than those of the *T. spelta* type (28 as compared with 45 per cent.), as found by the above-mentioned investigators. A high degree of resistance was shown by two *vulgare* forms and one *persicum* of the *spelta* series, but these forms can hardly be recommended for hybridization on account of their poor production. It was observed in some of the spelt varieties that a higher incidence of infection was obtained on the seed-grain when the glumes were removed. The inherent susceptibility of such varieties, therefore, can only be determined after the removal of the glumes.

Inoculation experiments with *T. caries* should be conducted on late sown winter and early sown summer wheat, since the incidence of infection is highest at low temperatures, the summer wheat sown on 6th April being very much less severely attacked than that sown on 23rd March, when germination was slower and the period of susceptibility prolonged.

Bunt-resistant strains of summer wheat were derived from crosses between resistant winter varieties (Fürst Hatzfeld, Hohenheimer 77, and Heil's Dickkopf) and susceptible summer ones (368_{20} and 378_{20} (Blaue × Grüne Dame) and Horning's Grüne Dame). This recombination of the summer form and resistance is considered to prove that the latter is independently transmitted on a Mendelian basis. The progeny of the immune strains showed no tendency to segregation, indicating that the inheritance of immunity is recessive. The inheritance of slight (as compared with extreme) susceptibility is also recessive, denoting that the factors determining resistance all tend in the same direction. No resistant strains were derived from crosses between two susceptible parents, while the progeny of moderately susceptible and susceptible parents all showed over 20 per cent. infection. It is assumed, on the basis of the segregation ratios, that resistance and susceptibility are each dependent on several factors, the varying percentage infections obtained by the author in his hybrids being correlated with the relative proportions of these.

The plants remaining healthy in the infected plots showed a shorter haulm length and a lower grain weight than the non-

inoculated controls, and it appears, therefore, that the tissues even of immune plants contain mycelium the further development of which is arrested by certain natural properties of the plant, any of which may be inheritable. These are the factors which, in the author's opinion, really are the producers of resistance.

Collections of *T. caries* from various parts of Germany and other countries caused differing degrees of infection on the same varieties. Thus, a culture from Landskrona (Sweden) produced only 6·3 per cent. infection on the Vavilov IV variety, which showed 38·3 per cent. when inoculated with the spores of a Halle strain. Generally speaking, the bunt collections from Cosel (Upper Silesia), Breslau, Bonn, Weihenstephan, and Hohenheim were the most virulent, those from other parts of Europe and America causing less severe damage [ibid., vii, p. 775].

The inoculation of several resistant strains with bunt spore material obtained from susceptible and resistant varieties in the same locality resulted in slight differences of infection (1·7 to 8·3 in one case and 37·4 to 50·8 per cent. in another). It would seem that the host varieties offer unequal opportunities for development to the hyphae of different bunt strains invading their tissues, and thus exercise a selective influence on each line mixture of bunt spores [cf. ibid., viii, p. 436].

On the basis of the results obtained in these investigations, immunity from bunt is referable to inherited internal properties of the cell, which indirectly produce resistance. The recessive behaviour of immunity cannot be attributed to the absence of certain genes, since these have other vital functions to perform in the plant.

GIESEKE (A.). **Untersuchungen über das Verhalten von Winterweizen bei künstlicher Infektion mit Steinbrand (Tilletia tritici).** [Investigations on the reaction of winter Wheat to artificial inoculation with bunt (*Tilletia tritici*).]—*Zeitschr. für Pflanzenzücht.*, xiv, 3, pp. 311–363, 1 fig., 1929.

The great majority of the 25 winter wheat varieties examined at Halle for their reaction to inoculation by *Tilletia tritici* [*T. caries*] were found to be highly susceptible to this fungus [see preceding abstract]. The only extremely resistant varieties were Hohenheimer 77 and Heil's Dickkopf, but several were moderately so, including Criewener 104, Fürst Hatzfeld, Strube's Kreuzung L, Krapphäuser dichtährig [close-eared], and Struy. These varieties maintained their resistance in the second year of cultivation.

The agreement in the incidence of infection between very closely related varieties may enable the character for bunt reaction to be used in the determination of varietal purity [cf. *R.A.M.*, viii, p. 556], but in this connexion the differing virulence of bunt strains of diverse origin must be taken into account.

An inverse correlation was found to exist between the incidence of total infection and the percentage of partial attack, i.e., the more resistant the variety the greater the percentage of infected plants showing only partial infection. In Heil's Dickkopf and Hohenheimer 77 the sori very often develop only in a few ears of a given plant. Apparently healthy plants on infected plots showed

a general arrest of growth, manifested principally by a reduced weight of the grain and a shortening of the haulms, as compared with the non-infected controls. This is considered to prove that the mycelium of the fungus penetrates even the resistant varieties, the specific internal properties of which generally prevent its further development.

The results [which are tabulated] of three years' investigations of hybrid material are summarized. The high degree of susceptibility of the F_2 generation of resistant × susceptible crosses indicates that immunity is recessive. In the F_3 generation the progeny of healthy F_2 plants of these crosses segregate into groups ranging from highly resistant to susceptible, denoting that polymery is concerned in the determination of susceptibility. The occurrence of highly resistant strains within the resistant × susceptible crosses should form the basis of breeding experiments which are likely to prove successful. In agreement with these results is the derivation of resistant strains from crosses between two moderately susceptible varieties.

Slight hereditary differences in regard to bunt resistance probably exist between Heil's Dickkopf and Hohenheimer 77, the latter in all probability possessing one more immunity factor than the former. A similar difference appears to exist between Ackermann's Bayernkönig and Dietze's Dickkopf.

NOVÁK (S.). **K otázce infekce Pšenice výtrusy Tilletia tritici různého stáři.** [On the question of the infection of Wheat with *Tilletia tritici* spores of different ages.]—*Ochrana Rostlin*, ix, 2, pp. 30–32, 1929.

Some details are given of a field experiment made in 1927 at the Phytopathological Institute of Prague, in which three lots of wheat seed-grain of the variety Selekta ZIII were infected with *Tilletia tritici* [*T. caries*] spores collected in 1925, 1926, and 1927, respectively, and sown in adjacent plots. The plants in all three plots became heavily infected, having 263 bunted ears per sq. m. for the 1927 spores as against 203 for those of 1925. The controls remained entirely free from bunt. The experiment showed that *T. caries* spores retain their viability almost unimpaired for several years. This fact must be borne in mind when storing disinfected seed (especially when liquid fungicides are used), in order to avoid reinfection of the seed by old bags, sacking, and flooring. The question should also be investigated whether spores ploughed in with wheat débris may not retain their viability for several years in the soil and be capable of infecting new crops when brought to the surface by fresh ploughing.

ZIMMERMANN (F.). **Untersuchungen über die Eignung des Kurznassbeizverfahrens (Ge-Ka-Be Verfahrens) zur Beizung von Saatgetreide.** [Investigations on the suitability of the short liquid disinfection process (G-K-B process) for the steeping of cereal seed-grain.]—*Zeitschr. für Pflanzenkrankh. (Pflanzenpath.) und Pflanzenschutz*, xxxix, 6, pp. 209–243, 1929.

The results [which are fully described and tabulated] of the author's experiments in the control of wheat bunt [*Tilletia caries*

and *T. foetens*], stripe disease and covered smut of barley [*Helminthosporium gramineum* and *Ustilago hordei*], and loose smut of oats [*U. avenae*] by the short disinfection process were very satisfactory [*R.A.M.*, viii, p. 437]. The cost of the treatment is considerably lower than that of dusting, which is 4½ to 6½ times dearer for rye, 3 to 4½ times for wheat, and 5 times for barley, and it is concluded that the method may now be generally recommended.

NIETHAMMER (ANNELIESE). **Permeabilitätsstudien an Pflanzenzellen im Zusammenhange mit der Quecksilberbeizung der Samen.** [Permeability studies on plant cells in connexion with mercury disinfection of the seed.]—*Zeitschr. für Physik. Chem.*, Ab. A, cxlii, 4, pp. 309–319, 1929.

Following up the work of Zimmermann and Heubner in the determination of the mercury content of plant organs originating from mercury-treated seed [*R.A.M.*, viii, pp. 300, 558], the writer conducted a series of experiments to ascertain the method and extent of the penetration of mercury into wheat seed-grain and maize roots immersed for varying periods in a number of fungicidal preparations, including uspulun, germisan, kalimat, and ostan.

The results of the tests [full details of which are given] showed that the seed coats of wheat partially or completely precluded the entry of many of the preparations into the interior of the seed, so that the embryo and the nutrient tissue are not reached by the mercury, which is usually absorbed only during germination through the roots. This process cannot take place until the mercury has passed into the soil, where appreciable quantities must certainly be out of reach of the roots.

Most of the mercury compounds (including the above-mentioned fungicides in dilute solutions) were found to be absorbed by and penetrate to the central cylinder of maize roots, where they are rapidly diffused and pass to the stems. No adverse effects on growth were observed to follow.

FORSTER (H. C.) & VASEY (A. J.). **The relation between flag smut infection and manurial treatment.**—*Journ. Dept. Agric. Victoria*, xxvii, 6, pp. 321–330, 2 figs., 4 graphs, 1929.

An account is given in popular terms of observations made over a period of three years at Werribee, Victoria, on the effect of various manurial treatments in the permanent manurial plots, which were laid down in 1913, on infection of wheat by flag smut (*Urocystis tritici*).

The results obtained [which are tabulated, expressed graphically, and discussed] showed that in each year applications of lime up to 10 cwt. per acre markedly increased infection, as did applications of farmyard manure; when a mixture of both was applied infection was particularly severe. Superphosphate appears, from the 1928 experiments, to have no effect on the disease since increased dressings gave no better results than did smaller ones; long continued applications of this substance made no appreciable difference to the P_H value of the soil.

In 1928 the percentage infections in plots receiving, per acre,

1 cwt. superphosphate, the same + 5 cwt. lime, the same + 10 cwt. lime, and the same + 20 cwt. of lime were, respectively, 4, 10·9, 14·4, and 11·3. The P_H values for the same plots were, respectively, 6, 6·9, 8, and 8·3. Three other plots treated, respectively, (per acre) with 1 cwt. superphosphate, 10 tons farmyard manure, and the last-named + 10 cwt. lime showed, respectively, 3·7, 17, and 28·8 per cent. infection, as compared with 4·4 per cent. in an unmanured plot, the respective P_H values being 5·8, 6, 7·8, and 5·5.

PRIDHAM (J. T.), DWYER (R. E. P.), & HURST (R.). **Control of flag smut of Wheat by resistant varieties.**—*Agric. Gaz. New South Wales*, xl, 7, pp. 520–522, 1929.

After stating that flag smut [*Urocystis tritici*: see preceding abstract] is one of the most serious diseases of wheat in Australia, the author gives brief details of comparative resistance tests conducted since 1923 in New South Wales. The following varieties were found to be almost immune: Cedar, Forge, Galgalos, Geeralying, Red Rock, and Sindhi. Others are listed as highly resistant, moderately resistant, and susceptible or highly so. The best varieties at present grown are mostly susceptible, and none of the resistant wheats has as yet been sufficiently tested to be generally recommended.

MARCHIONATTO (J. B.). **La lucha contra el 'carbón volador' del Trigo. (Ensayos de orientación).** [The control of loose smut of Wheat. (Preliminary experiments).]—*Bol. Min. Agric. Nac.*, Buenos Aires, xxviii, 2, pp. 229–231, 1929.

In a series of preliminary experiments [the results of which are tabulated], the writer obtained good control of loose smut of wheat (*Ustilago tritici*) by the so-called 'hot air' treatment [*R.A.M.*, iv, p. 407]. The seed-grain of six varieties commonly cultivated in the Argentine was exposed for varying periods (30 minutes to 3 hours) to hot air at temperatures of 70° to 90° C. Germinative energy was considerably reduced by the treatment, especially in the San Martin, 38 M. A., and Record varieties, but ultimately the treated seed recovered to a large extent.

SMITH (N. J. G.). **Observations of the Helminthosporium diseases of cereals in Britain. I. The behaviour of Helminthosporium gramineum in a common Barley disease.**—*Ann. of Appl. Biol.*, xvi, 2, pp. 236–260, 2 figs., 1929.

In this paper the author expands in considerable detail the account of his investigations on the mode of infection in stripe disease of barley (*Helminthosporium gramineum*), an abstract of which has already been noticed [*R.A.M.*, iii, p. 513].

FICKE (C. H.) & MELCHERS (L. E.). **The effect of the digestive processes of animals on the viability of Corn and Sorghum smut spores.**—*Journ. Agric. Res.*, xxxviii, 11, pp. 633–645, 1929.

The investigation described in some detail in this paper was undertaken to test the effect on the viability of the spores of maize smut (*Ustilago zeae*) and sorghum kernel smut (*Sphacelotheca sorghi*)

of their passage through the digestive tract of cows and horses. The results of the experiments in which large doses (up to 4·5 and 5·4 lb. per cow and horse, respectively) of smut spores and smutted heads were fed to the animals showed that the viability of the spores of both species were almost entirely and permanently destroyed by this passage, but that the survival of the sorghum smut spores was somewhat greater than of the maize smut. In any case, the number of spores that remain viable in the faeces is so small that they may be disregarded as a means for the perpetuation and spread of the diseases by stable manure. Post-mortem examination of the contents of the alimentary tract of several horses indicated that for the most part the spores lose their germinability in passing through the stomach, and that their death is apparently caused by the action of acids present in that organ.

None of the animals tested appeared to experience ill effects from the ingestion of either the maize or the sorghum smut, and some individuals seemed even to relish the addition of smut to their food, especially at the beginning of the experiments.

Dobrozrakova (Mme T. L.). **Заметка о „снеговой" плесени в 1928 г.** [Note on the 'snow' mould in 1928.]—*Morbi Plantarum*, Leningrad, xviii, 1–2, p. 66, 1929. [German summary.]

Autumn sown cereals are stated to suffer every year from winter injury in the neighbourhood of Detskoye Selo [near Leningrad]. In 1927 investigations by Teterevnikova-Babayan showed that this condition was caused by a number of species of *Fusarium*, among which *F. avenaceum*, *F. graminearum* [*Gibberella saubinetii*], *F. falcatum*, and *F. solani* f. *minus* were the most frequent and the most virulent, while *F. nivale* (*Calonectria graminicola*) was not recorded in any of the cases investigated. In 1928, however, it was the last-named species that was exclusively found attacking autumn sown wheat and rye. It was noted that as the air temperature rose and the soil moisture decreased, the diseased plants recovered, but many succumbed to the fungus and the centres of infection stood out clearly by their thinned stands. At the beginning of July pinkish and later light brown perithecia of the ascigerous (*Calonectria*) stage were found in the fields. Perithecia formed in pure cultures on *Melilotus* stems, however, were always black.

These observations lead the author to believe that the identity of the species of *Fusarium* that cause winter injury to cereals is closely dependent on the meteorological conditions of each individual year.

Savoff (C.). **По-важнитѣ болести и неприятели на Царевицата у насъ и мѣркитѣ за борба съ тѣхъ.** [Chief diseases and pests of Maize in our country, and measures for their control.]——*Сведения по Земледѣлието* [*Agricultural Information*], Sofia, ix, 11–12, pp. 20–34, 1928. [Received September, 1929.]

In this paper brief notes are given on the incidence and economic importance in Bulgaria of the chief fungal diseases and insect pests of maize, together with brief recommendations for their control. The smuts listed are *Ustilago maydis* [*U. zeae*], *U. reiliana* [*Soro-*

sporium reilianum], and *U. fischeri* [*Aspergillus niger*] (which causes a hypertrophy of the grain and has spores measuring 4 to 6 μ in diameter). Rust (*Puccinia maydis*) is not of frequent occurrence in Bulgaria, where its alternate host is represented by three species of *Oxalis*. *Fusarium roseum* (*Gibberella saubinetii*) mainly attacks the grain, on which it usually forms a pink mycelial web, but sometimes develops under the cuticle and turns the grain itself pink. The fungus overwinters in the pericarp of the seed, in which it remains viable for three or four years. Flour prepared from infected maize is toxic for man and animals but, according to Naoumoff, the infected grain may be rendered innocuous by heating it to 100° [C.]. *F. maydiperdum* was discovered in Bulgaria in 1911. The fungus attacks the ears during their formation, and prevents setting of the grain; the dead organs are covered with a yellowish-grey or pink mycelium consisting of thin hyphae, 3 to 4 μ in diameter, with 4- to 5-septate conidia. Other fungi mentioned include *F. gramineum*, *F. zeae*, *F. aurantiacum*, *F. heterosporium*, *Pythium de Baryanum*, *Sclerospora graminicola* (the plants attacked by which remain stunted and chlorotic. and the male inflorescences cannot emerge or are badly deformed; the mycelium produces slightly branched conidiophores which rarely form conidia and soon disappear; this stage is followed by the formation of large, brown oospores, measuring on the average 60 μ in diameter), *Coniosporium gecevi* [*Nigrospora sphaerica*: *R.A.M.*, vi, p. 758], *Ascochyta zeina*, and *Septoria maydis*.

HOPKINS (J. C. F.). **What is Diplodia in Maize?**—*Rhodesia Agric. Journ.*, xxvi, 6, pp. 587–595, 1 pl., 1929.

After stating that dry rot of maize (*Diplodia zeae*) is widely distributed throughout Rhodesia (where it is one of the chief causes of reduced yields) and the Union of South Africa, the author describes in popular terms the symptoms and effects of the disease and the life-history of the fungus; the causes which predispose to infection are noted, and control is recommended by seed selection and treatment, together with farm routine methods directed to reduce infection from maize stubble and trash and to secure rapid drying of the grain.

Another common cob rot of maize, characterized by a rose-pink discoloration, is identical in general appearance with the heart or ear rot caused by *Gibberella saubinetii*, which though only the *Fusarium* stage has been found, is believed to be the fungus concerned.

McCLEERY (F. C.). **Exanthema of Citrus in New South Wales.**—*Agric. Gaz. New South Wales*, xl, 6, pp. 397–406, 4 figs., 1929.

A full account is given in popular terms of exanthema of citrus trees [*R.A.M.*, v, p. 667; vii, p. 643], a comparison being made between the symptoms on different hosts, especially oranges, lemons, and mandarins. The gum symptoms are diagnostic, and cause bark excrescences, stained terminal twigs, gum pockets, and marked fruits. The most obvious symptom, though not always present, is the bunched, dark green appearance of the foliage.

The disease, which has been known in New South Wales since

1909, is the most important disease of citrus in the coastal regions, prevailing especially in the Mangrove Mountain, Gosford, Wyong, and Dora Creek localities and in isolated areas in the Hills district of Cumberland. It is probably due to malnutrition, and is favoured by inadequate drainage and the presence of a hard pan near the soil surface; in New South Wales it is definitely associated with sandy soils, the addition to which of organic matter proved beneficial in controlling the condition.

McCleery (F. C.). **Control of exanthema of Citrus in New South Wales.**—*Agric. Gaz. New South Wales*, xl, 7, pp. 523–534, 5 figs., 1929.

A full account is given in popular terms of experiments conducted at Gosford, New South Wales, in the control of exanthema of citrus trees [see preceding abstract].

On 18th–19th October, 1927, one application of Bordeaux oil emulsion 6–4–50, containing 1 per cent. of red spraying oil, was given to 112 Washington Navel oranges, 111 others being sprayed with a 6–4–100 mixture, while 112 trees remained untreated as controls. At this date the trees, which showed pronounced exanthema and had for some seasons lost most of their fruit from premature dropping, the rest having many marked by the disease, were just past full blossom, and the petals were falling freely. The sprayed trees later showed a striking improvement; in April, 1928, the controls were sprayed, though as no blossoming occurred this could not affect their yield, but by July they also showed great improvement in appearance. In September, 1928, the two originally treated plots yielded, respectively, 121 and 116 cases of fruit, as compared with 27 in the controls, though a year previously the yield in this area had been remarkably uniform. Both the concentrations used appeared to be equally effective. Eighteen months later the trees were maturing a good crop of fine quality fruit, but as the foliage showed some secondary symptoms a further treatment was recommended for October.

An adjacent block of six-year-old Sweet Rind lemons showing pronounced and uniform exanthema was similarly treated, 42 trees being sprayed with the 6–4–100 and 42 others with the 6–4–50 emulsion on 19th October, 1927, while the same number were left unsprayed. Many were not bearing fruit, and on others the crop was much reduced owing to early fruit-fall. By April, 1928, the sprayed trees showed marked improvement and the increase in yield was approximately as great as that obtained with the oranges. Equally good results were given by either concentration of the mixture.

Two plots each of 48 Emperor mandarins were sprayed with the 6–4–50 emulsion on 22nd September and 17th October, 1927, respectively; at the former date the spring growth had developed but the blossoms were in the very early bud stage, and at the latter the trees were almost in full bloom. This experiment was less successful, but the sprayed plots yielded, respectively, 53 and 58 cases of fruit as compared with 41 in the untreated control.

Five orange trees 6- to 20-years old were given soil treatment with copper sulphate; the application was made to the smaller

trees by spreading the crystals on the soil to about 5 ft. from the butts and chipping them in with a hoe, and to the larger trees by chipping in the crystals in a ring about 2 ft. wide just outside the spread of the branches. Four applications, each of 2 lb. per tree, were made in April and August, 1926, June 1927, and April 1928. All the trees had been severely affected for years; not one was producing marketable fruit and they showed nearly all the symptoms of the disease. By June, 1928, the two youngest trees had completely recovered, while two others had improved and were carrying light crops of normal fruit; even the worst tree made very strong growth, and by May, 1929, bore about half a case of healthy fruit. In that year the growth on all the trees was almost free from any sign of the disease, though no improvement was noted in a number of adjacent comparable trees which had been kept untreated as controls.

The use is recommended of 6–4–100 emulsion applied as a spray at about the full blossom stage, or copper sulphate crystals as a soil dressing, at the rate of 1 to 2 lb. per tree for trees six to eight years old (older trees may be given up to 4 lb. per tree), applied in late winter or early spring, followed by another dressing in November or December, if necessary.

Emphasis is laid upon the importance of selecting orchard sites with good drainage. Where drainage is bad it should be remedied by underground drains, and where a hard pan exists it should be broken up or altogether avoided.

The use of farmyard manure, *abattoir* waste, and similar materials, or of loam or sandy loam for re-soiling, is recommended, and it is also suggested that green manure cover crops should be grown in young orchards.

DOIDGE (E[THEL] M.). **A study of some Alternarias affecting Citrus in South Africa.**—*S. Africa Dept. of Agric. Sci. Bull.* 69, 29 pp., 12 figs., 1929.

Species of *Alternaria* closely resembling *A. citri* Pierce [*R.A.M.*, vi, p. 287] cause various types of injury [which are described] to citrus leaves and fruits in South Africa, including a leaf spot of rough lemon seedlings, internal black rot of navel oranges, stem-end rot of stored citrus fruits, and a stylar-end rot of Eureka lemons.

Strains of *Alternaria* isolated from these injuries were compared with two strains of *Alternaria* isolated from a navel orange from Rhodesia and a tangerine purchased in London, with three of Fawcett's isolations of *A. citri*, Bolle's isolation of *A. tenuis* [ibid., iv, p. 61], and *A. mali* [ibid., iii, p. 585] received from Roberts. An extensive series of inoculations, the results of which are fully described, was carried out by the author with all these strains.

It was not possible to distinguish between the South African strains [the cultural characters of which are described], that from the Rhodesian orange, and Fawcett's *A. citri*. In culture the spore characters were remarkably uniform, but on lemon leaves the spores were larger than those of the cultures. All the strains sporulated less freely after prolonged cultivation on artificial media

and soon became sterile. The latter cultures were of a lighter colour than the rest and produced a more copious aerial mycelium.

When inoculated into oranges, lemons, or grapefruit all the South African strains, some of which were more virulent than others, produced typical centre rot and in certain conditions stem-end rot. Only the two strains isolated from leaf spot and stylar-end rot of lemons attacked the living leaves of lemon seedlings. None of the strains of *A. citri* received from Fawcett caused spotting of lemon leaves, but one caused brown spots on the leaves of cherry.

The strain isolated from a tangerine in London was identical with Bolle's isolation of *A. tenuis.* Both organisms produced typical centre rot when inoculated into orange, lemon, or grapefruit, and caused spotting of cherry leaves, but had no effect on lemon or apple leaves. In culture they were greyer and less olivaceous than *A. citri*, produced less aerial mycelium, and sporulated much more freely, sporulation being unaffected by prolonged cultivation on artificial media, and the range of size of the spores being smaller.

A. mali Roberts caused spotting of previously injured apple leaves but did not attack cherry or lemon leaves. It produced a centre rot when inoculated into citrus fruit but was less virulent than *A. citri* or *A. tenuis* and caused less discoloration of the tissues. It was distinguished from the two latter by its action on starch. Potato cylinders used as a medium for *A. mali* gave a strong sugar reaction with Fehling's solution, scarcely any starch remaining unconverted. Similar potato cylinders on which *A. citri* and *A. tenuis* were grown gave a strong blue-black starch reaction and only a very slight red precipitate with Fehling's solution.

A bibliography of 27 titles is appended.

DOIDGE (E[THEL] M). **Further Citrus canker studies.**—*S. Africa Dept. of Agric. Bull.* 51, 31 pp., 1 plan, 1929.

In describing the progress of the campaign conducted since 1918 in South Africa for the eradication of citrus canker (*Bacterium* [*Pseudomonas*] *citri*) [cf. *R.A.M.*, vi, p. 143] the author states that only two farms still remain definitely dangerous, although a periodical inspection is made of all those where the disease was previously found. The four trees which showed canker in 1927 at Buffelspoort were adjacent to infected trees which had been destroyed in 1918–20, and only a few cankers were found on one or two leaves. At De Kroon two trees were also found to be cankered; both of these were also contacts.

The administrative costs of the citrus canker inspection (including a number of other services, the inspectors being seconded for other duties) for the ten years 1917–27 amounted to £56,193.

From 1918 to 1922 the planting of citrus trees in the quarantined areas was severely restricted; all nurseries in these areas had been destroyed, and the raising of nursery stock was prohibited; no trees might be planted within three miles of an infected orchard, and such trees as were planted under a permit had to be obtained from nurseries in other areas.

A comparison of the activity of *P. citri* in old and new canker

lesions indicated that infection takes place rather more readily when the organism is derived from a recently formed canker, but that the organisms in the old cankers on living leaves retain their viability, their pathogenic activity being only slightly less than that of the bacteria in new lesions.

When four indigenous species of Rutaceae were tested for susceptibility to *P. citri* it was found that *Fagara capensis* (the only one found commonly in citrus-growing areas) and *Clausena inaequalis* were moderately susceptible and *Vepris* [*Toddalia*] *lanceolata* and *Calodendron capense* immune or highly resistant.

Field observations showed that *P. citri* may be carried over long distances by running water. The Buffelspoort farm in the Rustenburg District had several heavily infected citrus orchards on the banks of the Sterkstroom river; in the summer of 1918 this river overflowed, and many of the trees were temporarily submerged. In an orchard on another farm some three miles farther down two rows of orange trees were also submerged, fully 10 per cent. of which later showed heavy canker infection. Canker was also found after the flood on lemon trees on another farm at least six miles distant from Buffelspoort.

Experimental evidence [full details of which are given] was obtained which clearly demonstrated the danger of replanting infected sites even six years after the destruction of the original orchards.

The paper terminates with a description of the comparative cultural, morphological, and biochemical characters of five other well-known yellow plant pathogens closely related to *P. citri* which are found in South Africa, and of cross-inoculations which indicated that each is restricted to its own particular host plant.

A bibliography of 24 titles is appended.

WILLIAMS (R. O.). **Limes and wither-tip. Introduction and breeding work in Trinidad.**—*Trop. Agriculture*, vi, 7, pp. 187–191, 4 pl., 1929.

After indicating the economic importance of wither-tip (*Gloeosporium limetticolum*) disease of limes in Trinidad and Dominica, the author gives an outline of the history of the species and varieties of *Citrus* which have been introduced or bred since 1920 in Trinidad with a view to controlling the disease by the cultivation of a resistant and commercially acceptable species [cf. *R.A.M.*, vii, p. 373]. So far none of the plants tested [brief botanical descriptions of which are given] has produced fruit of the required characteristics, although *C. aurantifolia* P.I. No. 2182 crossed with West Indian lime has given interesting results, and one of the progeny, which has been named Trinidad hybrid No. 1, shows promise of commercial value.

BALLY (W.). **Spinnewebziekten en djamoer oepas bij Koffie.** [Thread blights and pink disease of Coffee.]—*Arch. voor Koffiecult. Nederl.-Indië*, iii, 1, pp. 1–24, 2 pl., 11 figs., 1929. [English summary.]

After discussing Petch's classification of the thread blights into the marasmioid and the *Corticium* groups, and giving reasons for

rejecting the alternative divisions proposed by Schwarz [*R.A.M.*, vi, p. 384] and Steinmann [ibid., vii, p. 675], the author gives a full account of the true thread blight occurring on coffee in Java and Sumatra, first described by Zimmermann as cobweb disease (*Meded. 's Lands Plantentuin*, lxvii, 1904). Since that date there have been scarcely any references to the disease, but an examination has recently been made of material from Salatiga and Tandjong Djati containing mycelial hyphae, anchor cells, and hyphae with short lateral branches, as described by Zimmermann. A marasmioid thread blight without anchor cells has been found on a wild species of Rubiaceae.

In connexion with a description of pink disease of coffee (*C. salmonicolor*), attention is drawn to the risk of confusion between this fungus and the other thread blights, and an account is given of the different stages of the former (thread blight mycelium, cushions, *Corticium* and *Necator* fructifications). It is still uncertain whether the mycelium of *C. salmonicolor* penetrates the plant through the lenticels and stomata, or whether it enters through the epidermal cells. Hyphae have not been found in the plant tissues. The *Corticium* fructifications are stated to originate in the thread blight mycelium, while those of the *Necator* type arise directly from the cushions. Control measures should be instituted at the beginning of the rainy season, infected branches being cut off and burnt *in situ*. Branches bearing fructifications should first be treated with a standard fungicide, e. g., carbolineum, to prevent the spread of the spores.

The koleroga disease of coffee (*C. koleroga*) [ibid., viii, p. 705] is not known to occur in the Dutch East Indies; this fungus is thought to be possibly closely allied to, or identical with *C. theae* [ibid., v, p. 136]. The causal organism of the so-called 'silver thread' disease occurring on coffee in Surinam belongs to the *Corticium* group but is not identical with any of the species hitherto described in the East.

SREENIVASAYA (M.) & MAHDIHASSAN (S.). **A study of the symbiotic fungus from the Mysore lac insect.**—*Journ. Indian Inst. Sci.*, xiiA, 6, pp. 69–72, 1929.

The Mysore lac insect [*Laccifer lacca*] is normally associated with an ellipsoidal yeast-like, intracellular organism [*R.A.M.*, vi, p. 163], which was grown in three series of artificial media, to test its requirements in (*a*) carbohydrates, (*b*) nitrogenous compounds, and (*c*) inorganic constituents generally.

After eight weeks' growth the weight of the fungus was determined. The results [which are presented in tabular form] showed that, among the sugars, maltose and gum arabic yield the highest crops. Maltose and sucrose are practically indistinguishable in yielding the highest gum content, as shown by the greatest viscosity at 25°. Lactose and inulin were not utilized by the fungus. In the nitrogen series, the heaviest yeast crops were produced by uric acid and acetamide, followed by ammonium sulphate. The greatest quantity of gum is produced with uric acid. In the third series, the magnesium-free medium gave the highest yield and (with the medium containing excess of calcium) the largest gum content.

A large-scale fermentation was carried out to study the products on a medium composed of 20 gm. potassium nitrate, 10 gm. hydrogen potassium phosphate, 5 gm. each of sodium chloride and magnesium sulphate, 100 gm. glucose, and 2 l. water. After two months the filtrate was found to reduce ammoniacal silver and to give a yellow precipitate with phenylhydrazone, indicating the presence of an aldehyde or ketone. The fungus crop was ground up with quartz sand and extracted with ether, giving a light yellow oil with the property of drying on absorbing oxygen from the air. Comparative bio-combustion experiments with the Mysore symbionts and *S[accharomyces] cerevisiae* showed that the former produced only one-third as much carbon dioxide as the latter.

POSPELOFF (V. P.). **Микроорганизмы-симбионты и их отношение к болезням насекомых.** [Symbiotic micro-organisms and their relation to diseases of insects.]—*Plant Protection* (formerly *La Défense des Plantes*), Leningrad, vi, 1–2, pp. 13–20, 2 figs., 1929.

The author very briefly describes a few observations and experiments on parasitic diseases of insects, tending to confirm previous views [which are summarized] that the majority of such diseases are caused by micro-organisms usually living in symbiosis and only becoming virulent under conditions adverse to the latter. In a brood of locusts [species not stated] artificially inoculated with a virulent culture of *Coccobacillus acridiorum* [*R.A.M.*, v, p. 596], a normal inhabitant of the locust's intestine, all the insects kept under high humidity and low temperature conditions perished, while those that were transferred after successful infection to normal temperature and humidity recovered. Larvae of the Noctuid *Agrotis* [*Euxoa*] *segetum* kept in glass cages sullied with their excrements developed a disease caused by *Bacillus agrotidis typhoides* auct., which is also a normal symbiont of the insect. Fresh cultures from the diseased larvae were found to be pathogenic by ingestion both to the caterpillars of *E. segetum* and to those of *Pieris brassicae,* in which they caused an acute septicaemia. After the lapse of one year, however, the cultures were only infective when inoculated through punctures. A similar disease of *E. segetum* was observed under natural conditions in the governments of Vologda and Leningrad in larvae which were hibernating with the gut still full of excrement; the causal organism was again *B. agrotidis typhoides* which had caused a disease resembling 'flacherie' of silkworms. In larvae which had had time to void the solid excrement but not the liquid before hibernating, another form of disease was seen: the body appeared filled with a clear liquid containing crystals and the chitinous layer was thickened. Larvae thus affected were not able to pupate; the body gradually swelled to one and a half times the normal size, when it became black and mummified. Pure cultures of *B. fluorescens liquefaciens* were isolated from the diseased insects. A number of the larvae do not blacken and dry up, but remain white and preserve a firm adipose tissue, in which a species of *Isaria* is found. The first symptom of this disease is the appearance

in the adipose tissue of elongated, hyaline, sack-like bodies containing nuclei which multiply by direct division.

Some observations were made in 1926 on an outbreak of the polyhedral disease of the nun moth [*Lymantria monacha*] in the forests of central Russia, which in 1927 effectively exterminated this moth. Infected caterpillars that were taken to the laboratory and kept at a lower temperature than that obtaining in the forests remained alive and did not develop apparent symptoms of the disease, but it was found that the nuclei of their hypodermal cells were hypertrophied and contained polyhedral bodies in course of formation, and that their internal juices contained both passively floating polyhedral bodies and small, actively motile bodies with a membrane, strongly reminiscent of the cocci described as development stages of *Chlamydozoa* by Prowazek (*Arch. Protist.*, x, 1907) and by Komarek and Breinde (*Zeitschr. Angew. Entom.*, 1924). When cultured on sugar agar the body juice of the diseased larvae produced colonies of a pathogenic yeast, which was identified as belonging to the genus *Debaryomyces*. Over 50 per cent. of the caterpillars of *Mamestra* [*Barathra*] *brassicae*, *Malacosoma neustria*, and *E. segetum* which were fed on pure cultures of this yeast developed clear symptoms of the polyhedral disease, while other species tested remained immune. The yeast was not recovered, however, either from the intestine or the body juices of the caterpillars which contracted the polyhedral disease. It is thought probable that the above-described, coccus-like small bodies in *L. monacha* are normal symbionts of the moth larvae [cf. ibid., viii, p. 571], and that their pathogenic activity was due to some external factors which interfered with the normal digestion of the caterpillars, a process to which the ingestion of the pathogenic yeast may have contributed to a large extent.

DRASTICH (L.) & ROZSYPAL (J.). **Mšice Hrachová (Macrosiphum pisi Kalt.) a Entomophthora aphidis Hoffm.** [The Pea aphid (*Macrosiphum pisi* Kalt.) and *Entomophthora aphidis* Hoffm.] —*Acta Soc. Sci. Nat. Morav. Brünn*, iv, pp. 345–364, 11 figs., 1928. [Abs. in *Bot. Centralbl.*, N.F., xv, 1–2, pp. 47–48, 1929.]

During the catastrophic outbreaks of the pea aphid (*Macrosiphum pisi*) on lucerne in South Moravia and Slovakia in 1926–7, the most effective control was achieved by its natural enemy, the fungus *Entomophthora aphidis* [*R.A.M.*, i, p. 391]. The yellow resting spores (azygospores), which measure 25 to 36 μ in diameter, produce a promycelium with conidium-like spores which germinate on the insect; the germ-tube branches within the host and the hyphae ultimately emerge through the skin to form the first generation of conidial spores, which appear as a greyish-yellow coating. The conidia are disseminated by the aphids through contact with the dead insects, and also by wind.

TOEPEL (T.). **Systemic blastomycosis.**—*Journ. Amer. Med. Assoc.*, xciii, 1, p. 32, 1929.

The writer briefly describes a fatal case of blastomycosis in a 37-year-old man who died six months after pricking the left index

finger with a thorn. The condition progressed by the direct route along the bones to the upper arm, thence by metastasis to the right lung, subsequently to the left lung, and eventually to the left kidney. Blastomycetes were found in the pus of the finger, in an abscess on the arm, and in the sputum.

De Gregorio (E.). **Contribution à l'étude des épidermomycoses.** [Contribution to the study of the epidermomycoses.]—*Ann. de Dermatol.*, Sér. VI, x, 5, pp. 512–532, 2 figs., 1929.

This is a general discussion on recent investigations of the epidermomycoses, with special reference to the view of certain workers that yeast-like fungi, e. g., *Oidium* [*Candida*] *albicans* and species of *Saccharomyces*, *Parasaccharomyces*, *Cryptococcus*, and *Monilia*, are concerned in the etiology of eczematic lesions and dysidrosis on the hands and feet [*R.A.M.*, vi, p. 484]. The writer's own researches, conducted in Spain and in Sabouraud's laboratory in Paris, lend no support to this opinion, and he considers that the actual lesions are invariably due to species of *Epidermophyton* or *Trichophyton* [ibid., vii, p. 635], while the yeasts so commonly occurring on the surface are purely secondary.

Stearn (Esther W.) & Stearn (A. E.). **Comparative inhibiting effect of gentian violet and mercurochrome on the growth of certain fungi.**—*Journ. Lab. and Clin. Med.*, xiv, 11, pp. 1057–1060, 1929.

The authors' results in a series of experiments to test the efficacy of gentian violet and mercurochrome in varying dilutions in inhibiting the growth of certain fungi are tabulated and briefly described. The organisms used were *Blastomyces* sp., *Oidium mycosum* (from an infected hand), *O.* [*Candida*] *albicans* (from a tongue lesion) [*R.A.M.*, viii, p. 444], *Trichophyton rosaceum*, *T. granulosum*, and *Achorion schoenleini*, all grown on nutrient bouillon. Gentian violet was found to be considerably more effective (50 to 500 times) than mercurochrome in the suppression of growth, *O. mycosum* being inhibited at 1 in 10,000,000, *C. albicans* 1 in 750,000, *Blastomyces* sp. at 1 in 500,000, *T. rosaceum* at 1 in 4,000,000, *T. granulosum* at 1 in 250,000, and *A. schoenleini* at 1 in 8,000,000.

Toma (A.). **Sur l'infection des cheveux 'in vitro' par les champignons des teignes.** [On the infection of hairs *in vitro* by ringworm fungi.]—*Ann. de Dermatol.*, Sér. VI, x, 6, pp. 641–643, 1929.

Using a small quantity of a medium poor in nutritive value (0·25 cg. sugar, 2·5 cg. peptone, and 2·5 cg. physiological serum), with the addition of a number of guinea-pig hairs, the writer obtained very satisfactory growth of *Achorion gypseum*. The hairs invaded by the fungus presented exactly the same appearance as those attacked *in vivo*.

FRIED (S. M.) & SEGAL (M. B.). **The hematogenous production of dermatomycoses: experimental studies.**—*Arch. of Dermatology*, xix, 1, pp. 98–104, 1929. [Abs. in *Trop. Dis. Bull.*, xxvi, 8, pp. 679–680, 1929.]

A full account, preceded by a summary of previous investigations, is given of the authors' experiments on the production of skin lesions by inoculating the blood stream of 29 laboratory animals (chiefly rabbits) with *Trichophyton gypseum* [cf. *R.A.M.*, viii, p. 506]. An area on the back or side was shaved and scarified and an emulsion of spores introduced into a vein with strict precautions to avoid accidental contamination. After an incubation period of 12 to 18 days, 11 of the animals (38 per cent.) developed skin lesions on the scarified areas only. The disease lasted from 6 to 12 weeks. The character of the lesions was apparently not affected by the amount of material injected. It is suggested that the scarification leads to local inflammation, during the course of which the spores are able to traverse the capillary endothelium which is normally an impenetrable barrier. The fungus evidently exhibits a marked predilection for the skin.

The results of a second series of tests, in which blood was taken from the heart at varying periods after the original intravenous injection, proved that the bulk of the fungus disappears from the blood within 24 hours, though some spores may circulate for as long as 3 days.

LEGGE (R. T.), BONAR (L.), & TEMPLETON (H. J.). **Incidence of foot ringworm among college students. Its relation to gymnasium hygiene.**—*Journ. Amer. Med. Assoc.*, xciii, 3, p. 170, 1929.

Continuing their researches on the incidence of ringworm of the feet among students of both sexes at Berkeley University, California [*R.A.M.*, viii, p. 645], the writers examined 1,000 men and 997 women who had been receiving physical instruction for two terms. It was ascertained that 78·6 per cent. of the men and 17·3 per cent. of the women showed ringworm of the feet, while in the former group 9·3 per cent. of crural ringworm was also detected. The great preponderance of infection among the men is attributed largely to the fact that they are accommodated in an old gymnasium with no modern sanitary facilities, whereas the women's gymnasium is equipped with the most recent hygienic improvements.

ACTON (H. W.) & MCGUIRE (C.). **'Cooly itch.' A purulent folliculitis due to the Trichophyton violaceum variety indicum.**—*Indian Med. Gaz.*, lxiv, 5, pp. 241–246, 8 pl. (3 col.), 1929.

'Cooly itch' (*sensu* Castellani and Chalmers: Manual of Tropical Medicine, 1919) is defined as an extremely irritative, chronic pustular folliculitis commonly attacking low-class Indians in Calcutta and occasionally observed also among seafaring Europeans accustomed to walk barefooted about the docks. The condition is more prevalent among men than women; in the former the pustules, which are surrounded by a reddish-purple zone of induration, occur

chiefly round the hair follicles of the legs and thighs, though the chest, neck, and beard may also be attacked; while in the latter the forearm is mostly affected. Infection is spread to a great extent by contact and friction, e. g., the cross rub of the clothes in walking, and it is further very common among wrestlers, who rub their bodies with soil, in which the fungus is often present, preparatory to each bout.

Full particulars are given of the morphological and cultural characters of the fungus isolated from infected areas. The organism corresponds closely to *Trichophyton violaceum*, from which it differs substantially only in two points. The cooly itch fungus shows a predilection for the hairs of the body and beard while *T. violaceum* prefers the scalp and beard. The colonies of the former on Sabouraud's glucose agar present a velvety, mole-coloured appearance distinct from the violet tint of *T. violaceum*. Both fungi possess terminal and intercalary chlamydospores. The colour and site differences are not considered sufficient to justify the establishment of a new species, and the Indian fungus is accordingly named *T. violaceum* var. *indicum*.

Satisfactory results in the control of the disease have been given by three applications daily for three weeks to the affected areas of 5 per cent. gentian violet solution. In cases of marked induration of the corium, epilation of the hairs by X-rays may be necessary to effect a cure.

CATANEI (A.). **Observations statistiques et parasitologiques sur les teignes chez les indigènes du Sud constantinois.** [Statistical and parasitological observations on ringworm among the natives of southern Constantine.]—*Bull. Soc. Path. Exot.*, xxii, 5, pp. 299–302, 1929.

Pursuing his studies on the incidence and etiology of ringworm among the natives of Algeria [*R.A.M.*, viii, p. 446], the writer found that this condition occurred in 140 of the 719 children (19·4 per cent.) examined in southern Constantine. Fifty-six of the cases were due to *Trichophyton glabrum* and *T. violaceum* [ibid., viii, p. 507], 83 to *Achorion schoenleini*, and one to a mixture of these organisms.

NEVES (A.). **Onychomycose (?) por 'Acrotheca pedrosoi' (Brumpt), 1921.** [Onychia (?) associated with *Acrotheca pedrosoi* (Brumpt), 1921.]—*Brasil Med.*, xliii, 3, pp. 69–70, 1 fig., 1929. [Abs. in *Trop. Dis. Bull.*, xxvi, 8, p. 684, 1929.]

Acrotheca [*Trichosporium*] *pedrosoi* [*R.A.M.*, viii, p. 645] was isolated from the nails of a 48-year-old man suffering from onychia, but the author was unable to determine whether it was actually the cause of the condition or merely a concomitant.

GOMES (J. M.) & PESSOA (S. B.). **Reproducçao experimental da dermatite verrucosa.** [Experimental reproduction of dermatitis verrucosa.]—*Brasil Med.*, xliii, 10, pp. 255–257, 6 figs., 1929. [English summary. Abs. in *Trop. Dis. Bull.*, xxvi, 8, p. 685, 1929.]

A form of dermatitis verrucosa is caused in Brazil by *Acrotheca*

[*Trichosporium*] *pedrosoi* [see preceding abstract]. Inoculation experiments on dogs and rabbits with this organism resulted (at the second attempt) in the production of warts at a distance from the site of injection.

BENEDEK (T.). **Ist das Cephalosporium asteroides griseum grützii (Grütz, 1925), Benedek, emend. 1927, mit dem Cephalosporium acremonium Corda 1839 identisch?** [Is *Cephalosporium asteroides griseum grützii* (Grütz, 1925), Benedek, emend. 1927, identical with *Cephalosporium acremonium* Corda 1839?]—*Dermatol. Wochenschr.*, lxxxviii, 26, pp. 892–897, 7 figs., 1929.

Referring to his previous observations on specific differences within the genus *Cephalosporium* [*R.A.M.*, vii, p. 639], the author refutes Grütz's opinion that *C. asteroides griseum grützii* (Grütz) Benedek, previously named by him *C. kiliense* (*Dermatol. Wochenschr.*, lxxx, p. 765, 1925) is identical with *C. acremonium*. Since 1926 the morphological and physiological differences between these species have been fully maintained in the writer's cultures.

C. asteroides griseum grützii (a human pathogen originally isolated from the gummy exudate of ulcers) is characterized by branched, hyaline, septate hyphae, 1 to 1·5 μ broad and up to 11·4 to 15·2 μ long, simple conidiophores, 20 to 60 by 1·2 to 1·5 μ, and oblong to ovoid, hyaline conidia measuring 3 by 1·5 μ. On Grütz's glycerine maltose agar the fungus forms smooth, greyish-white colonies, with folds radiating from the centre in the form of a star. A reddish tint (quite distinct from the faint pink of *C. acremonium*) develops during the fourth or fifth week on Grütz's medium, while on Sabouraud's and Benedek's media a grey coloration of varying intensity is assumed.

The hyphae of *C. acremonium* are 2·5 to 3 μ broad, the conidiophores 40 to 60 by 3 μ, and the oval conidia 3 to 4 by 1 to 1·5 μ. On Grütz's and other standard media the colonies are snow-white, later very pale pink (at which stage they closely resemble *Trichophyton rosaceum*). A further important difference is that *C. acremonium* is a harmless saprophyte, frequently occurring as a contamination in culture tubes, while *C. asteroides griseum grützii* is pathogenic to man.

CATANEI (A.). **Caractères de l'infection expérimentale des animaux par un Sporotrichum trouvé dans la nature.** [Characters of the experimental infection of animals by a *Sporotrichum* found in nature.]—*Comptes rendus Soc. de Biol.*, ci, 23, pp. 780–782, 1929.

Further experimental work has been carried out with the *Sporotrichum* resembling *S. biparasiticum* recently detected in well water [*R.A.M.*, viii, p. 722]. In the lesions induced in laboratory animals by inoculation the hyphae are of variable length and 2 to 2·5 μ in width, while rounded elements, 3 to 4 μ in diameter and often containing bipolar granulations, may also be observed, especially in the early stages. In the spleen of a mouse which succumbed to peritoneal granulations, the fungus formed

agglomerations of tangled hyphae and rounded or ovoid elements, 2·5 to 4·5 μ in diameter. Most of the experiments in the transmission of infection from one animal to another gave negative results, as also did sero-agglutination tests for humoral reactions to the presence of the fungus. The initial inoculation appears to confer a certain degree of sensitivity comparable to that characterizing human sporotrichosis.

THOMPSON (L.) & MONTGOMERY (H.). **An organism isolated from two cases of 'hairy tongue'.**—*Journ. Amer. Med. Assoc.*, xciii, 2, pp. 114–115, 2 figs., 1929.

Full clinical details are given of a case of 'hairy tongue' in a 59-year-old woman. The furry material giving rise to the popular name for the condition was found to consist of epidermal scales. Cultures from the affected part on dextrose agar and broth yielded a species of *Actinomyces* characterized by abundant mycelium (especially on the latter medium) in addition to bacillary forms. The same organism was isolated from a second case presenting less marked symptoms of 'hairiness'.

GIORDANO (M.). **Di un caso di dermatomicosi da Penicillium crustaceum.** [On a case of dermatomycosis due to *Penicillium crustaceum*.]—*Arch. Ital. Sci. Med. Colon.*, ix, 7, pp. 397–400, 1 fig., 1928. [Abs. in *Trop. Dis. Bull.*, xxvi, 8, p. 684, 1929.]

A 12-year-old Sudanese boy living since early childhood in Tripoli presented numerous pale areas scattered over the body, chiefly round the ankles; they were rounded, with irregular margins, and varied in size from that of a lentil to a two-lira piece. Cultures on Sabouraud's maltose yielded a *Penicillium* identified by Prof. Sanfelice as *P. crustaceum* [*R.A.M.*, vi, p. 483]. The condition was greatly relieved by treatment with salicylic acid.

MORAN (T.). **Recent advances in the low-temperature preservation of foodstuffs.**—*Journ. Soc. Chem. Ind.*, xlviii, 34, pp. 245T–251T, 9 graphs, 1929.

Recent investigations at the Low Temperature Research Station, Cambridge, have shown that the optimum temperature for the preservation of meat is 36° to 38° F., at which point a balance is struck between two forces, one improving the palatability of the meat and the other promoting spoilage through the action of moulds [cf. *R.A.M.*, iv, p. 367], bacteria, and enzymes. With most foodstuffs stored at temperatures near freezing point, moulds are more active than bacteria in the causation of spoilage, but there are certain exceptions to this rule, notably fish. Under the supervision of the Food Investigation Board, experiments are now in progress on a number of trawlers to reduce the bacterial decomposition of the fish by improved methods of cooling and temperature control. Another important factor in food preservation is the adjustment of atmospheric humidity, which should be low enough to prevent the action of moulds and bacteria but not so reduced as to involve excessive loss of weight by evaporation of water.

YESAIR (J.). **The action of disinfectants on moulds.**—*Abstracts of Theses, Chicago Univ., Sci. Ser.*, vi, pp. 361–365, 1929.

The author describes the results of a survey of packing-houses undertaken to determine the conditions favouring the spoilage of meat and meat products in storage, and to test the efficacy of various measures for its control [see preceding abstract].

The rooms for smoked meat hanging and bacon packing are maintained at a temperature of about 65° F., with a relative humidity of approximately 70 per cent. The temperature of the sausage drying-room is 48° to 56° and the humidity 65 to 80 per cent., while beef is kept at 34° to 36° for two to six weeks.

The organisms isolated from contaminated meat and from the walls and equipment of packing-rooms were *Penicillium expansum*, *Aspergillus glaucus*, *A. clavatus*, *A. niger*, *Mucor racemosus*, *Rhizopus nigricans*, *Alternaria tenuis*, *Monascus purpureus*, *Monilia sitophila*, *Oidium* [*Oospora*] *lactis*, *Fusarium* sp., and *Mortierella* sp. *P. expansum*, *A. glaucus*, and *Mucor racemosus* occurred with the greatest frequency.

Inoculations showed that after an incubation period of a fortnight *A. glaucus* and *Alternaria tenuis* produced black spots on sausages, while *Monascus purpureus* caused the development of red areas. The other moulds bleached the sausages. *A. tenuis*, *Aspergillus glaucus*, *R. nigricans*, and *M. purpureus* penetrated the substratum and could only be removed with difficulty from meat. *P. expansum* caused weak spots in sausage casings and soft spots on ham and bacon owing to the proteolytic enzyme in the mycelium.

The spores of all these organisms were destroyed by five minutes' heating at 140°, and as the minimum temperature used in the cooking of meat products is 165° for 7 to 15 minutes, it is inferred that contamination must occur subsequent to this process. It was found that all the moulds grew well at 46° to 50° and luxuriantly at 68° to 72°, while *P. expansum* alone developed at 98°. The growth of the organisms was not perceptibly affected by varying amounts of relative humidity between 0 and 100 per cent. The experiments showed that the prevailing conditions of temperature and humidity in the packing-houses, while essential to the proper maintenance of the products, are also favourable to the development of micro-organisms.

Of the various methods of control applied in the course of these investigations, sodium hypochlorite solutions of varying concentrations proved most effective. Ozone also acted as a fungicidal agent, but only when used at high concentrations for lengthy periods, and in the presence of moisture.

ZYBINA (Mme S. P.). Опытная работа по изучению болезней Льна в Нижегородской губ. в **1927–28** гг. [Experimental work in the study of Flax diseases in the Nijni-Novgorod government in 1927–8.]—*Morbi Plantarum*, Leningrad, xviii, 1–2, pp. 67–100, 3 graphs, 1929. [German summary.]

This paper is a progress report on experimental work which was carried out in 1928 at the Nijni-Novgorod Plant Protection Station in the investigation of the chief fungal diseases of flax. The phyto-

pathological examination [by a method which is briefly described] of 300 samples of flax seed of various origins showed that the majority were heavily infected with micro-organisms, among which the parasites *Colletotrichum linicolum* and *Polyspora lini* were commonly found, while there was a small amount of *Fusarium lini*. Although the highest contamination was found in samples of exotic origin (India, Asia Minor, and North Africa), some pure lines and varieties propagated by certain Russian seed selection stations also showed heavy infection. A few samples, some of which originated from private growers, were remarkably free from infection and it is proposed to determine whether this freedom from contamination is only fortuitous or is an inheritable characteristic in the progeny of such seed.

Field experiments with the tested seeds showed that an appreciable amount of seedling mortality occurred only in the progeny of the samples showing an infection of 20 per cent. or more, while the death rate of seedlings raised from seed with not over 10 per cent. infection was very uniform and comparatively low. Later in the season, however, the different incidence of disease in the two groups was much less marked, presumably owing to secondary infections in the field. The dead flax seedlings and plants were infected by *C. linicolum* in 75 per cent. and by *F. lini* in 37 per cent. of the cases investigated, except in fields where flax was grown for several years consecutively, where both organisms had accumulated in about equal proportions. There was evidence of a direct relationship between the mortality of flax plants in the field from parasitic fungi and the amount of rainfall during the summer of 1928, which was marked by fairly moderate temperatures and abundant precipitations. The incidence of the disease was highest in plots on which flax followed potatoes or rye, except where flax followed flax.

Seed disinfection trials with fungicidal dusts showed that höchst [tillantin] was by far the most effective for the control of the fungal diseases; germisan, uspulun [tillantin R] and tutan trockenbeize No. 225 were much less satisfactory, while copper carbonate, copper sulphate, and lime gave but very slight control.

Kletschetoff (A. N.). Заметка о новых грибах на Льне. [Note on new fungi parasitic on Flax.]—*Plant Protection* (formerly *La Défense des Plantes*), Leningrad, vi, 1–2, pp. 235–236, 1929.

In 1925 the author isolated from diseased flax roots in the neighbourhood of Moscow a species of *Helminthosporium*, which he at first considered to be a saprophyte, as the affected plants came from 'flax sick' soil heavily infected with other parasitic fungi. A preliminary experiment made in 1928 showed, however, that the fungus is capable of infecting young flax seedlings and of entering the roots at any point. As it differs morphologically from *H. lini* [*R.A.M.*, iii, p. 273] it is considered to be a new species and is named *H. linicola*. The conidiophores are brown, septate, and 23 to 31 by 6 μ. The conidia in nature are brown, 8- to 11-celled, measure 53 to 77 by 7·7 to 11·5 μ, and their terminal cells are usually of a lighter colour than the median. On artificially inoculated flax

seedlings the number of cells in the conidia varied from 4 to 14, the majority being 7- to 10-celled, and the maximum size of the conidia was 100·1 by 11·5 μ. A Latin diagnosis is appended.

In 1928 the author isolated from diseased flax stems three strains of *Fusarium* which differed greatly in cultural characters. On oat agar the first form gave a very weak vegetative growth, did not form spores, and did not colour the substratum; the second form grew well, produced a small number of conidia, and coloured the substratum at first red or pink, and later dark red, while the third gave a good vegetative growth and a very abundant production of conidia, but did not colour the substratum. Preliminary experiments indicated that all three forms are pathogenic to germinating flax seeds, but vary in their virulence. A closer study of all these organisms is in hand.

DILLMAN (A. C.). **Flax resistant to wilt developed at Experiment Stations.**—*U.S. Dept. of Agric., Yearbook of Agric., 1928*, pp. 296–297, 1929.

Several new flax varieties resistant to wilt (*Fusarium lini*) have been developed at the North Dakota and Minnesota Agricultural Experiment Stations, the former producing Linota, Buda, Bison, and Rio, and the latter Chippewa, Redwing, and Winona [*R.A.M.*, vi, p. 257; vii, p. 592]. The Linota and Buda varieties are well adapted to the heavy soils of the Red River Valley, being more or less resistant to rust [*Melampsora lini*: ibid., vi, p. 358] as well as to wilt. Chippewa resembles Linota in type, but Winona is susceptible to rust. Rio is an early maturing selection of the Argentine type of flax, entirely immune from rust and highly resistant to wilt, but very susceptible to 'pasmo' disease [*Phlyctaena linicola*: ibid., vii, p. 796]. Redwing is resistant to both wilt and rust.

DOWSON (W. J.). **On the stem rot or wilt disease of Carnations.**—*Ann. of Appl. Biol.*, xvi, 2, pp. 261–280, 1 pl., 1929.

Losses due to a stem rot or wilt of carnations are stated recently to have become serious in English glasshouses. The disease, which is most prevalent during the summer, is characterized by a slow withering of the shoots one after another, the green colour gradually changing to a pale straw-yellow. The roots decay, and under moist conditions the cortex of the collar becomes soft and rotten; this symptom, however, is not constant, the disease being primarily a wilt.

A form of die-back due in part to the same organism was also noted in which one or more stopped shoots died back from the topmost node, the rest of the plant remaining unaffected. Symptoms of wilting were also observed on cuttings, many of which died when the temperature and moisture were high, though some recovered when these were reduced.

Observations and experiments indicated that the stem rot disease is more prevalent under relatively moist soil conditions; when the soil in two parts of an experimental house was kept, respectively, wetter and drier than normal, many more plants succumbed to stem rot on the wet soil.

Isolations from diseased material yielded various strains of *Fusarium* [*R.A.M.*, iv, p. 24]. The wilted cuttings gave a strain identified by Wollenweber as *F. avenaceum*; *F. herbarum* was obtained from plants showing stem rot and also from the die-back type of disease; *F. culmorum* was isolated from stem-rotted plants; young wilted plants yielded another strain, *F.* 2, which in culture yielded a pink sector or saltant, *F.* 3; and a similar source gave *F.* 4.

Inoculation experiments with these fungi, in which spores or mycelium were introduced into the nodes, internodes, and collars of seedlings and of 18-months- and 2-year-old carnations under different conditions of atmospheric temperature and humidity showed that *F. avenaceum* acted as a weak parasite to shoots at relatively high temperatures and humidity but was not parasitic under ordinary conditions, *F. herbarum* caused die-back, *F. culmorum* caused both die-back and stem-rot, while the other three strains were non-pathogenic. Plants from 18 months to 2 years old were the most rapidly affected, infection taking place only through wounds in the author's experiments.

Experiments with filtered liquid in which *F. culmorum* had been growing and in which carnation shoots were placed showed that a toxic substance was conveyed by the transpiration current to the chlorophyll tissues, which were killed. No gumming was produced in the shoots though it is found in those attacked by the fungus, and the first sign of wilting was a slight loss of colour.

On solid media *F. avenaceum* produced abundant white aerial mycelium, while *F. herbarum* and *F. culmorum* formed white aerial hyphae streaked with pink or yellow, or both, the substratum being constantly rosy-pink. The optimum temperature for growth was 26° C. and the maximum about 38°.

It is concluded that under English conditions the stem rot or wilt of carnations is caused by *F. culmorum*, the die-back of stopped shoots is caused both by this and *F. herbarum*, while the occasional wilting of very young plants is due to *F. culmorum*. Infection with these species takes place at 24° to 26° in high atmospheric and soil humidity and requires the presence of wounds. It is probable that deep planting also favours infection. Sterilization of the beds, preferably by steam, is recommended as the best means of control, care being taken that no contaminated soil adheres to the roots of the cuttings. The beds should be kept somewhat dry and the temperature as low as possible during summer.

A bibliography of 16 titles is appended.

McKay (M. B.), Brierley (P.), & Dykstra (T. P.). **Tulip 'breaking' is proved to be caused by mosaic infection.**—*U.S. Dept. of Agric., Yearbook of Agric., 1928*, pp. 596–597, 1 fig., 1929.

'Breaking' in self-coloured tulips is defined as 'a remarkable change in which the anthocyanin pigment in the flower is segregated into irregular stripes up the middle of each segment or fine feathering upon its edges'. Other modifications in affected plants include a distinct mottling of the leaves, pigment markings in the

stem, and reduction in size, height, vigour, and productivity. This condition is believed to have occurred almost as long as tulips have been cultivated, pictures dating from 1640 to 1650 being on record.

Recent experiments have shown conclusively that breaking, formerly attributed to some inherent change in the bulb itself, is an infectious disease of the mosaic type [*R.A.M.*, viii, pp. 311, 725]. The condition was successfully transferred by inoculation from 15 varieties of 'broken' tulips, including four commercial Rembrandts (broken Darwin) and one or more representatives of the cottage, breeder, and Darwin types, to a single variety, Clara Butt, whence it was again transferred to 17 other varieties. In all cases the flowers broke in a similar manner, indicating that only one mosaic disease was involved.

Infection was readily secured by three methods of inoculation, viz., leaf mutilation in which the juice of diseased plants was applied to the leaves of healthy plants by crushing between the thumb and fingers (30 per cent. infection), tissue insertion from diseased to healthy stalks (33 per cent.), and aphid transfer (12 per cent.). Of the three species of aphids used in the tests, *Illinoia solanifolii* [*Macrosiphum gei*], *Myzus persicae*, and *M*[*acrosiphum*] *pelargonii*, the first-named transmitted the disease most effectively, the two others giving low percentages of infection and failing entirely in some cases.

Breaking is stated to be easily controllable by the separation of healthy and mosaic stocks in planting, drastic roguing of affected plants during the growing season, and possibly by the use of aphid sprays or dusts where the insects are abundant and the disease is prevalent.

PASSALACQUA (T.). **Una batteriacea parassita delle Aloë nei giardini di Palermo, Bacterium aloes.** [A bacterium parasitic on Aloes in the gardens at Palermo, *Bacterium aloes*.]—*Riv. Pat. Veg.*, xix, 5–6, pp. 105–110, 1929.

A full account is given of a bacterial disease of numerous [named] species of *Aloe* growing at Palermo, characterized by a withering of the leaf apex.

Diseased material from *A. plicabilis* showed the presence of numerous bacteria, which were isolated and the cultural characters of which are described. On potato agar growth passes through three stages. In the first, viscous drops are formed; in the second a thin, white, compact, rugose pellicle appears which is insoluble in water; this in the third stage swells, softens, turns yellowish and then darkens. At 20° to 25° C. the last stage is reached in five or six days. These stages correspond to three phases of development of the organism. In the first, rapidly moving, monotrichous bacteria are seen, movement ceasing when they form into chains of 2 to 10 or into groups. They measure 1·5 to 2·5 by 0·2 μ, are Gram-negative and aerobic. In the second stage the bacteria are immobile and densely massed; finally spore formation begins, and the pellicle dissolves. The oval, slightly olivaceous spores measure 1 by 0·05 μ.

Artificial inoculations [details of which are given] of young healthy leaves of *A. plicabilis* gave positive results, and the disease is accordingly attributed to this organism, which is named *Bacterium aloes* n. sp.

It is thought that insects are probably responsible for transmission.

HUTCHINSON (W. G.). **An undescribed species of Macrophoma and of Volutella occurring on Pachysandra terminalis.**—*Mycologia*, xxi, 3, pp. 131–142, 4 figs., 1929.

In 1925 the author received from Virginia diseased specimens of the widely grown ornamental evergreen plant, *Pachysandra terminalis,* infected with a hitherto undescribed species of *Volutella* which produced a constriction of the stem and irregular brown areas on the leaves. The sessile to stipitate, seashell-pink sporodochia averaged 5 to 6 mm. in diameter, and the 3- to 7-septate setae were 250 to 450 by 4 to 7 μ. The hyaline spores measured 2·3 to 6·1 by 0·9 to 2·4 μ, averaging 3·99 to 5·29 by 1·34 to 2·3 μ. The optimum temperature for germination and for mycelial growth was 28° C. The mycelium was found to be intracellular, and inoculations showed that the fungus (which is named *V. pachysandrae*) is parasitic to some extent, developing, however, only when the plant becomes weakened or wounded. A Latin diagnosis is given.

On some of the plants a species of *Macrophoma* occurred on black pustules on the dead or partially dried stems. Inoculation experiments [brief details of which are given] indicated that this fungus is a saprophyte. It is named *M. pachysandrae* n. sp. and a Latin diagnosis is given.

JANICSEK (M.). **Untersuchungen über den durch Pflanzenschutzmittel verursachten Kupfergehalt der Drogen.** [Investigations on the copper content of drugs caused by the application of plant protectives.]—*Heilpflanzen Versuchsstat.* (*Budapest*) *Bull.* 5, pp. 317–322, [? 1929. Abs. in *Chem. Zentralbl.*, c (ii), 14, p. 1842, 1929.]

Extracts of *Melissa officinalis* and *Mentha crispa* from plants which had been treated with 2 per cent. Bordeaux or 1 per cent. Burgundy mixture for the control of *Septoria* [*melissae*: *R.A.M.*, viii, p. 268] and *Puccinia* [*menthae*: ibid., iv, pp. 58, 377], respectively, were found to contain, 14 days after spraying, appreciable quantities of $CuSO_4$. The amount found in *Melissa officinalis* treated with Bordeaux mixture was 16·5 per cent., compared with 46·59 per cent. where Burgundy mixture was used. The corresponding figures for *Mentha crispa* were 9·93 and 17·17 per cent., respectively. The presence of these comparatively large quantities of $CuSO_4$ in household drugs is considered to involve some risk to health.

BRYZGALOVA (Mme V. A.). Влияние ржавчинного грибка **Puccinia suaveolens (Pers.) Rostr.** на развитие сорняка **Cirsium arvense.** [Effect exerted by the rust *Puccinia suaveolens* (Pers.) Rostr. on the development of the weed *Cirsium*

arvense.]—*Morbi Plantarum*, Leningrad, xvii, 3–4, pp. 101–118, 1928. [German summary. Received August, 1929.]

Details are given of experiments which were made in 1925 and 1926 at the Irkutsk [south Siberia] University in the biological control of the perennial weed *Cirsium arvense* [*Cnicus arvensis*] by means of *Puccinia suaveolens*, since preliminary observations had indicated that the weed is highly susceptible, the parasite frequently killing all its above-ground organs. The rust is carried over from season to season as mycelium in the cortical parenchyma of the roots and stolons of the host. New shoots produced by infected stocks are usually of a lighter green colour than normal, and on emergence the leaves of such shoots already bear numerous orange-coloured pycnidia. In spring the pycnidial stage lasts from 10 to 12 days, but this period is progressively shortened as the season advances, lasting only one or two days in September and October. It is followed by the uredo stage, and 10 to 15 days later by the teleutospores, the host generally succumbing two or three weeks after the appearance of the last-named. Uredospores formed late in the autumn were shown to be able to overwinter in the dead host tissues. The teleutospores could only be germinated after the winter resting period, but as their viability was very low even under optimal conditions for germination, it is not believed that they play any considerable part in the persistence of the fungus.

The results of numerous infection experiments both on young seedlings and old stocks of *C. arvensis* showed that a satisfactory control of the weed by the rust is not to be expected, owing to the capacity of the plant to produce an extensive system of stolons, the rate of growth of which is several times that of the mycelium in them. In a typical case, in which an old stock had been repeatedly infected during the two years of the experiment, a final examination showed that the mycelium had only developed in two stolons to a distance of 25 and 30 cm., respectively, from the stock, while the total length of the stolons attained 3·1 m. Out of nine new shoots produced by this stock in 1926, only two were diseased. This conclusion was further confirmed by a field experiment, in which plots of the weed heavily infected artificially with rust in 1925, produced in 1926 as large a growth as control plots, no significant difference being found in the incidence of the disease in both.

Eremeyeva (Mme A. M.) & Karakulin (B. P.). Ржавчина Подсолнечника по наблюдениям на Краевой Нижне-Волжской С.-Х. Опытной Станции. [Observations on the Sunflower rust at the Lower Volga Regional Agricultural Experiment Station.]—*Morbi Plantarum*, Leningrad, xviii, 1–2, pp. 11–30, 1929. [German summary.]

After a brief review of former investigations of the sunflower rust (*Puccinia helianthi*) [*R.A.M.*, vii, p. 297 *et passim*], the authors give a detailed description of their study of the disease in 1928 in the Lower Volga region, where the sunflower is widely cultivated as an oil-seed crop and the rust frequently causes heavy losses. Preliminary tests showed that the locally produced sun-

flower seed almost invariably carries some uredo- and teleutospores of the rust, but the spores obtained by washing and centrifuging the seed failed to germinate in every case (possibly owing to the simultaneous development of bacteria in the cultures), while teleutospores taken directly from fragments of leaves mixed with the seed gave a germination of 2 or 3 per cent. in tap water.

Although no experiments were made to determine the part played by the spores adhering to the seed in the spring outbreak of the rust, it is not thought probable that they are of any importance compared with those on the dead sunflower leaves and stems that are left after harvest. In a series of experiments almost all the seedlings sown on soil into which such plant débris had been superficially worked, or where sunflower stems had been stacked during the previous winter, bore numerous pycnidia and aecidia on their cotyledons and the first two pairs of leaves, whereas on a control plot, from which the plant débris had been carefully removed and which was forked over, the aecidia appeared a fortnight later and in much smaller numbers. In fields sown to sunflower for several years consecutively, from 16 to 20 per cent. of the seedlings bore aecidia early in the spring, while in contiguous crop-rotated fields the percentage was not over eight. Lastly, observations showed that the rust, under natural conditions, first appeared on sunflower volunteer plants from the preceding year, thus forming a primary source of uredospore infection for the cultivated crop in early spring.

Owing to the exceptionally wet summer of 1928, aecidia were formed as late as August on the top leaves of the maturing plants. It is believed that these new infections originated from teleutospores on dead stems remaining on the soil from the preceding crop, since experiments showed that these spores retain their viability and infective power throughout the summer, while newly formed teleutospores rarely germinate.

A close connexion was established between the appearance of the uredo stage and the presence of aecidia, since this stage developed with the greatest intensity, and was earliest, in or near plots most heavily infected with the latter, the degree of intensity gradually diminishing as the distance increased. Further infections with the uredo stage are brought about by air currents, preliminary experiments having shown that over 14,000 uredospores may settle on a single sunflower leaf in the course of three hours during a light wind, and that they are capable of infecting both very young and older leaves.

Observations appeared to indicate that, in general, the crops are but slightly rusted up to the flower bud formation stage, and that the intensity of the disease strikingly increases after flowering up to the time of maturity, when it is at its highest. This would show that natural rust development is not dependent on dates of sowing or the like, but on the growth stage of the host. This was confirmed by a small series of infection experiments, which showed that the formation of the teleuto stage is mainly dependent on the physiological condition of the host and not on its age, since teleutospores began to appear on cotyledons and young leaves, just as on older leaves, in the first stage of dying off, while vigorous green

leaves rarely bore any but uredospores. It was also noted that the formation of the teleutospores may be delayed by cutting off the inflorescence from the maturing plant. In inoculation experiments, the incubation period with aecidiospores was from six to eight, and with uredospores from five to seven days. Pycnidia began to appear nine to eleven days after inoculation with teleutospores, and the aecidia were formed from eight to ten days after the pycnidia.

Cross-inoculations with *P. helianthi* on *Helianthus giganteus*, *H. divaricatus*, *H. strumosus*, *H. grosse-serratus*, *H. scaberrimus*, *H. tuberosus*, and *H. maximiliani* gave negative results. Under experimental conditions aecidio- and uredospores from the sunflower infected the weed *Xanthium strumarium*, and conversely, but observations tend to show that the weed is very rarely, if at all, infected under local field conditions. The other species of *Xanthium* tested were entirely immune. There was some, though inconclusive, evidence of varietal and individual resistance among the sunflower varieties tested.

The main lines of control recommended are the removal and destruction by fire of all remnants of sunflower crops, adequate crop rotation, and selection of resistant varieties.

Nilsson-Leissner (G.) & Sylvén (N.). **Studier över Klöverrötan (Sclerotinia trifoliorum).** [Studies on Clover rot (*Sclerotinia trifoliorum*).]—*Sveriges Utsädesförenings Tidskr.*, xxxix, 3, pp. 130–158, 14 figs., 1929.

One of the most serious obstacles to clover cultivation in Sweden (especially in the south) is *Sclerotinia trifoliorum* [the life-history and effects of which are fully described: *R.A.M.*, viii, p. 110], which caused exceptionally heavy damage in 1925–6 and 1926–7.

In Germany the apothecia of the fungus develop in July, but in more northerly regions they are not usually formed until the end of August or September, or they may even be delayed until the following spring under adverse weather conditions. The asci develop most freely in mild autumn weather, at the beginning of winter, or in the spring.

Vertically placed apothecia discharged their spores to a height of 1 cm. in moist air, and this range was scarcely exceeded by those lying horizontally. Under dry conditions a distance of 2 cm. was reached. Apothecia left to dry on an open shelf in the laboratory were able to discharge the spores up to a distance of 6·5 cm. when placed horizontally. The fact that ascospore dissemination is favoured by drying agrees with Kølpin-Ravn's observations (*Ugeskr. for Landmaend*, 1909) concerning the intensity of the disease in Denmark in 1906, when infection culminated during February and March, a period characterized by sunny days and slight frosts at night. In the field the dispersion of the ascospores is no doubt assisted by the wind, but it must be remembered that the great majority are driven against the nearest plants and either remain attached to them or fall to the ground. The well-known prevalence of *S. trifoliorum* in densely sown, luxuriant crops is attributable to this mode of ascospore infection.

It is frequently stated in the literature on stem rot that the

attacks of the fungus are restricted to newly sown stands, but at any rate in Svalöf and other parts of Sweden this is not the case. Two- and three-year-old stands may be so severely infected that the plants die off in large numbers, and under favourable weather conditions an attack beginning in a newly sown stand may continue in the following years. Infection has often been observed in eight-year-old lucerne and three-year-old clover stands.

Under very humid conditions the mycelium often passes from the exterior of one plant to those in the vicinity [cf. ibid., iv, p. 482], thereby contributing to the spread of infection. Once the disease reaches the sclerotial stage the plants are generally doomed —at any rate in the case of red clover (*Trifolium pratense*), in which the root-collar is attacked. The writers' observations in experimental plots indicate that white clover (*T. repens*), which seemed to be almost dead as a result of stem canker during the winter of 1927–8, recovered completely in the course of the summer.

It has been shown by a study of winter temperatures [which are tabulated], as registered at Lund observatory at 8 a.m. during the period from October to March (1900 to 1928), that all the really severe attacks of stem canker took place in mild winters, infection reaching a climax after a succession of favourable seasons. Attempts are frequently made to combat the disease by cutting down the clover crop in the year of sowing, and these may very well be successful if the harvesting is done sufficiently early (preferably in August) to give the new leaves time to mature before the principal period of spore dissemination in October.

In addition to red and white clover, the following hosts are also susceptible to *S. trifoliorum* in Sweden: alsike clover (*T. hybridum*), forest [zigzag] clover (*T. medium*), crimson clover (*T. incarnatum*), lucerne, *Medicago lupulina*, *Anthyllis vulneraria*, *Lotus corniculatus*, *Onobrychis sativa*, broad beans (*Vicia faba*), and a number of species of *Astragalus*. Of these, *M. lupulina*, *T. pratense*, *T. hybridum*, *T. repens*, and lucerne are the most susceptible. Early varieties of clover are more susceptible than late ones, such as Göta and Weibull's.

A series of cross-inoculation experiments [full details of which are given] was conducted to ascertain the possibilities of interspecific transmission of *S. trifoliorum*. It was found that Silesian red, alsike, and white clovers were all more heavily infected by apothecia from red clover (about 70 per cent.) than by those from the other two species. The apothecia from alsike caused about 60 per cent. infection on the same host but scarcely more than 30 per cent. on the red and white. The white clover apothecia gave about 60 per cent. infection on each species.

ROTHERS (B.). О двух новых грибах, найденных в Северо-Двинской губернии. [Two new fungi recorded in the government of North Dvina.]—*Plant Protection* (formerly *La Défense des Plantes*), Leningrad, vi, 1–2, pp. 233–234, 1929.

Of the two species of fungi, considered to be new to science, which are described in this paper, the following is of phytopathological interest. All the varieties of red clover (*Trifolium pratense*) tested at the North Dvina Branch of the Pan-Soviets

Institute of Applied Botany and New Cultures were found to be attacked by *Gloeosporium trifoliorum* n.sp., which, however, only caused appreciable damage to the late maturing varieties, as it first appeared in the second half of June. The main symptom was the development of elongated spots along the lateral veins of the leaves, which withered prematurely. The spots are at first light brown, later almost black but with a lighter margin. The acervuli are immersed and covered by the epidermis, through which they break when ripening; they are rounded, flat, and measure 133 to 225 by 95 to 152 μ in diameter. The spores are hyaline, short cylindrical, with rounded ends, more rarely ovoid or oval, and measure 4 to 8 (9) by 1·5 to 2 (2·5) μ. The fungus differs from *Sporonema phacidioides* chiefly in the total absence of a pycnidial structure, and from *G. trifolii*, *G. maculicolum* Sacc., and *G. caulivorum* [*Kabatiella caulivora*: *R.A.M.*, vii, p. 583] in the size of the stylospores. A Latin diagnosis is given.

PATTIE (R.). **The spread of fireblight.**—*Fruit World of Australasia*, xxx, 6, p. 215, 1929.

Referring to the appearance of fireblight [*Bacillus amylovorus*: cf. *R.A.M.*, vii, pp. 208, 416] in the centre of the South Island of New Zealand, the author calls attention to the necessity of preparing for its outbreak in the fruit-growing districts of Nelson and to the problem of eradicating the hawthorn [*Crataegus*], which serves to harbour the disease.

GIDDINGS (N. J.) & LEONIAN (L. H.). **Apple rust on host tissue in culture dishes.**—*Science*, N.S., lxx, 1805, p. 126, 1929.

Young detached York Imperial apple leaves were sterilized and inoculated with sporidia of *Gymnosporangium juniperi-virginianae* [*R.A.M.*, viii, p. 727], left under a bell jar for one or two minutes, and then placed in culture dishes containing modified Pfeffer's solution plus 0·5 per cent. glucose. The cultures were kept in a well-lighted room. The inoculated leaves developed rust spots and pycnidia in about the time required for natural infection on the tree. Pycnospores were produced in great abundance and one apparently normal aecidium was formed. No evidence of deterioration was observed in cultures maintained under these conditions for nearly nine months.

FAES (H.) & STAEHELIN (M.). **Les parasites, insectes et champignons, des arbres fruitiers. Résultats des traitements d'hiver, de printemps et d'été effectués au cours de l'année 1928.** [The insect and fungous parasites of fruit trees. Results of the winter, spring, and summer treatments carried out during the year 1928.]—*Annuaire Agric. de la Suisse*, xxx, 2, pp. 125–148, 6 figs., 1929.

The usual treatment in Switzerland for the combined control of apple codling moth (*Carpocapsa* [*Cydia*] *pomonella*) and scab (*Venturia*) [*inaequalis*] consists in the application, immediately after petal fall and again 8 to 15 days later, of copper or lime-sulphur mixtures with the addition of lead arsenate. Certain varieties, e.g., Blenheim, Sturmer, Cox's Orange, Charlamowsky,

Jonathan, and Stayman Winesap, showed severe russeting as a result of the 1 per cent. copper sulphate treatment, while Hubbardstone, Belle de Pontoise, Pineapple and Zuccalmaglio Pippins, Hammerstein, and Peasgood's Sans Pareille were not affected. The best control of scab was given by the application of 2·5 per cent. lime-sulphur plus 2 per cent. lead arsenate, which reduced the incidence of infection from 18 to 5 per cent. and caused no injury to the fruit.

BENLLOCH (M.). **La 'roya' del Peral.** [Pear rust.]—*Bol. Pat. Veg. y Ent. Agric.*, iii, 12–14, pp. 156–160, 4 figs., 1928. [Received September, 1929.]

Popular notes are given on the symptoms and life-history of pear rust (*Gymnosporangium sabinae*) [*R.A.M.*, vii, p. 251], which is stated to be widespread in Spain. Its alternate hosts are *Juniperus sabina*, *J. phoenicea*, and *J. communis*. Whenever possible these trees, or at any rate the infected portions, should be destroyed, but in mountainous regions where this is impracticable, pears should not be cultivated within a range of 500 m. to 2 km. from the nearest junipers. Applications of 1 per cent. Bordeaux mixture plus 50 gm. casein should also be given, beginning before the spots appear on the leaves. This generally occurs towards the end of the spring, though in cool situations the period of infection may be retarded.

WICKENS (G. W.). **Pear scab.**—*Journ. Dept. Agric. Western Australia*, vi, 2, pp. 220–222, 2 figs., 1929.

After stating that pear scab (*Venturia pirina*) is present in nearly every commercial orchard in Western Australia, the author gives brief details of a test in which 55 Vicar, Bartlett, and Winter Nelis pears were sprayed when in the pink blossom stage with home-made Bordeaux mixture (6–6–50); these produced nearly 100 per cent. clean fruit though the unsprayed trees showed nearly 100 per cent. of the fruit so badly scabbed as to be unmarketable.

FAES (H.). **Station fédérale d'essais viticoles à Lausanne et Domaine de Pully. Rapport annuel 1928.** [Annual report for 1928 of the Federal Viticultural Experiment Station at Lausanne and Domaine de Pully.]—*Annuaire Agric. de la Suisse*, xxx, 2, pp. 99–123, 1929.

Among the various items of phytopathological interest in this report the following may be mentioned. The efficacy of the post-blossom treatment of cherry trees with 1 per cent. copper sulphate mixtures against shot hole (*Clasterosporium*) [*carpophilum*] was maintained [*R.A.M.*, viii, p. 154]. The applications should be made (1) as soon as the fruits begin to form after petal fall, and (2) a week later.

WARDLAW (C. W.) & MCGUIRE (L. P.). **Panama disease of Bananas. Reports on scientific visits to the Banana growing countries of the West Indies, Central and South America.**—*Empire Marketing Board Publ.* 20, 97 pp., 30 figs., 1929.

In the first of these two reports [by Wardlaw] based on a tour of Bar-

bados, St. Lucia, Costa Rica, Guatemala, British Honduras, Jamaica, and Panama the author discusses the situation of the banana-growing industry in each country under such headings as climate, soil, cultivation, and economic conditions, and analyses the causes which have led to the abandonment of certain areas [cf. *R.A.M.*, i, p. 30; vi, p. 42]. He states that where records are available, as in Jamaica, they clearly show that Panama disease (*Fusarium cubense*) is not the most important limiting factor in banana cultivation; in Central America land has been abandoned for numerous reasons besides the presence of *F. cubense*, such as losses resulting from the use of diseased or defective planting material (most areas where the disease was once present have never been replanted), adverse soil conditions, soil deterioration from insufficient care, and poor upkeep and production methods generally. In any attempt to bring back abandoned areas into cultivation two distinct though probably related factors must be considered, viz., the treatment of the disease and the restoration and maintenance of soil fertility.

In the second report [by McGuire], based on a visit to the banana plantations of the United Fruit Company in Costa Rica, Almirante, Colombia, and Jamaica, the author in general supports Wardlaw's views as to the real causes of the abandonment of certain areas owing to the alleged presence of *F. cubense*, and states that while the disease has been of great importance, in many cases it has been only an accessory factor. In Colombia large areas where *F. cubense* has never been recorded have been abandoned owing to adverse soil conditions and insufficient care in upkeep. The disease is reported to have spread most rapidly in localities where an unsatisfactory soil militates against vigorous growth, but on the other hand resistant and immune varieties have shown remarkable vigour even on highly infected soils. Support is thus lent to two apparently conflicting views, one of which suggests that the Gros Michel variety is susceptible to the disease only when in a state of low vitality induced by unfavourable conditions of growth, while the other implies that this variety, by reason of its inherent, constitutional qualities, is susceptible under all conditions. The author considers that there is much to be said in support of either view.

WARDLAW (C. W.). **Panama disease research.**—*Trop. Agriculture*, vi, 7, pp. 192–197, 1929.

After giving a summary of the two reports on the Panama disease (*Fusarium cubense*) of bananas, noticed above, the author states that when actively growing roots of Gros Michel banana suckers were inoculated with the organism in ventilated moist chambers they did not become diseased, while in unventilated chambers they assumed a dark colour at their apex and ceased to grow. In pot inoculation experiments diseased roots were only found in the top inch of soil, which occasionally dried out, and at the pot sides, where drying out and heat scorch are liable to occur. These facts, supported by field evidence, indicate that infection of the Gros Michel banana roots is conditional on soil oxidation and variable water supply. In another series of experiments, in which superficially sterilized Gros Michel suckers inoculated with

F. cubense were kept in a carbon dioxide atmosphere, it was found that a noticeable amount of penetration took place in ten days, the tissue being affected to a depth of 1 to 1·5 cm. At this stage the infection may be characterized as 'mass infection', in contrast to its later stages, when it is generally found as a vascular infection. In pot experiments, it was noticed that while some of the suckers remained healthy, in others a major vascular infection originated at the neck of the sucker about soil level and proceeded upwards, but further investigation showed that all the diseased suckers had been invaded by the weevil borer (*Cosmopolites sordidus*).

In concluding the author believes that, taken as a whole, the results obtained so far show that, despite the virulent parasitism attributed to *F. cubense*, inoculated Gros Michel suckers grown under conditions of uniform moisture and adequate aeration resist fungal invasion by defensive structural and biochemical modifications.

BROADFOOT (H.). **Cool storage of fruit.**—*Agric. Gaz. New South Wales*, xl, 6, pp. 409–417, 1929.

An account is given in popular terms of the 'air circulating' and 'direct expansion' systems used for the cool storage of fruit in Victoria, practical recommendations being made as to the selection of plant and the construction and fitting-up of cool stores, together with notes on such points as the temperature, ventilation, and humidity of the chambers. The various factors affecting the keeping qualities of commercial varieties of fruits are briefly described and the most common storage troubles of apples and pears are listed, brief notes being given as to the causes which predispose to these conditions and the precautions which should be taken to avoid them.

MARSH (R. W.). **Investigations of the fungicidal action of sulphur. III. Studies on the toxicity of sulphuretted hydrogen and on the interaction of sulphur with fungi.**—*Journ. Pomol. and Hort. Science*, vii, 4, pp. 237–250, 2 pl., 1929.

Details are given of the author's experiments, briefly referred to in a previous paper [*R.A.M.*, vii, p. 655], in which he demonstrated that the germination of *Botrytis cinerea* and *Monilia* [*Sclerotinia*] *fructigena* conidia in hanging drops is completely inhibited by concentrations of 1 in 8,000 and 1 in 3,000 of sulphuretted hydrogen in the air, comparable results being also obtained with spores of *Fusicladium dendriticum* [*Venturia inaequalis*], *Cladosporium herbarum*, *Penicillium verdicatum*, and *Physalospora miyabeana*, while *M.* [*S.*] *cinerea* conidia gave no germination in 1 in 40,000 H_2S. On the other hand, a concentration of 1 in 2,000 H_2S was shown to have no effect on healthy strawberry plants subjected to its action during the night, and this observation is believed to indicate the possibility of a discrimination of the toxic effect as between flowering plant and fungus. It was found that living leaves of the strawberry and certain other plants when dusted with sulphur interact with the latter to produce a gas which exerts a marked inhibition on the germination of the spores of *M. fructi-*

gena. The fact that the germination of *M. cinerea* spores was inhibited when they were kept over *Podosphaera leucotricha* on apple leaves dusted with sulphur, or over *M. cinerea* and *M. fructigena* spores mixed with sulphur, is interpreted as indicating that the 'sensitiveness' of certain spores to sulphur is an indication of the ability of such spores, on germination, to interact with sulphur with the production of H_2S.

VEREȘCEAGHIN [VERESCIAGHIN] (B.). **Examinarea preparatelor in anul 1928.** [Preparations tested in the year 1928.]—*Buletinul Agricol, 1929*, Chișinău [Kishineff], 5, pp. 11–12, 1929.

This is a report on the insecticidal and fungicidal preparations that were tested in 1928 at the Bio-Entomological Station of Chișinău [Bessarabia], among which the only fungicide mentioned is sulfarol (Fabrica Chinoin). At a strength of 500 gm. in 100 l. water it successfully controlled rose mildew (*Sphaerotheca pannosa*) in the majority of cases, although on some bushes the control was only partial.

PAILLOT (A.) & PUSSARD (R.). **Sur l'emploi du sulfocyanure de cuivre contre les maladies de la Vigne et des arbres fruitiers.** [On the use of sulphocyanide of copper against diseases of the Vine and fruit trees.]—*Prog. Agric. et Vitic.*, xci, 22, pp. 531–533, 1929.

Experiments conducted to test the fungicidal value of sulphocyanide of copper (which contains approximately 49·5 per cent. copper as compared with only 23 per cent. in copper sulphate) showed that when vines were given two applications before and again after flowering of a mixture containing 500 gm. sulphocyanide in 1 hl. water this gave as good control of mildew [*Plasmopara viticola*] as was given by simultaneous applications to other vines of a cupric mixture containing an equivalent amount (1 kg. per hl.) of copper sulphate. In seasons of severe mildew these dosages should be doubled. In a further test the vines were given a preliminary application on 15th May of a mixture containing 500 gm. sulphocyanide and 600 gm. lead arsenate (with a casein spreader) per hl. water, followed on 31st May, 14th June, and 3rd July by further applications of the same constituents but with double the amount of sulphocyanide. The results resembled those given by applications on the same dates of Bordeaux mixture with calcium arsenate.

Pear trees treated against scab [*Venturia pirina*] by two applications after flowering of a mixture of 500 gm. sulphocyanide in 1 hl. water remained free from infection, though the untreated controls had at least 90 per cent. of the fruit affected. An old and previously unsprayed orchard of pears, very susceptible to scab, was sprayed on 20th February with a mixture of 2 kg. sulphocyanide paste (containing 50 per cent. water), 1·5 kg. lime, 50 gm. casein, and 10 l. anthracene oil in 90 l. water, followed by two further applications, on 23rd April and 14th May, of a mixture containing 1 per cent. sulphocyanide paste, 0·7 per cent. lead arsenate paste, and casein; the control obtained was quite com-

parable with that given by the ordinary copper-arsenate mixtures.

Young peach trees were sprayed against leaf curl [*Taphrina deformans*] on 3rd March with a mixture of 2 kg. sulphocyanide paste [in 1 hl. water], but as this, like Bordeaux mixture, gave only incomplete control it is considered that this dosage (equivalent to 0·5 per cent. sulphocyanide in powder) should be at least doubled for such dormant treatments. Other peaches treated on 20th February with 5 per cent. automobile oil emulsion, 2 per cent. sulphocyanide paste, and 300 gm. nicotine extract per hl. showed no trace of infection.

In all these experiments it was found that sulphocyanide of copper can be used under the same conditions and with the same success as the ordinary cupric mixtures both for winter and spring treatments of fruit trees; the preparation of the mixtures or emulsion is exceedingly simple, as the sulphocyanide needs only to be diluted with water.

VOELKEL (H.). **Methoden zur Prüfung von Pflanzenschutzmitteln. II. Mitteilung. Die Bestimmung der Haftfähigkeit von Stäubemitteln.** [Methods of testing plant protectives. Note II. The determination of the adhesiveness of dusts.]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xvii, 3, pp. 253–272, 4 figs., 2 diags., 1929.

Fungicidal or insecticidal dusts may be applied by three methods, viz., by cohesion, by dusting under atmospheric pressure, and by dusting without pressure. The first method is used in the case of dusts for seed disinfection, the seeds being brought into close contact and, as it were, smeared with the disinfectant by shaking in a closed container. Dusting under atmospheric pressure is effected by dusting-machines, and in certain circumstances when the operations are carried out from aeroplanes. When the aeroplane flies low above the tree tops, in tree dusting work, the dust is seized by the air current set in motion by the propeller and so pressed down on the tree tops. Dusting without pressure is effected by the production round the plant of a cloud of disinfectant, the individual particles of which settle on the various organs by means of their own weight and the movement of air. This method is employed in the production of 'mist clouds' from aeroplanes and in dusting with bags.

The various requirements in the physical composition of the disinfectant dusts in each of these three methods are discussed, and a full description and explanation are given of the technique and application of Görnitz's method (*Anz. für Schädlingskunde*, iii, 9, 1927) for the determination of the degree of adhesiveness of these preparations. The results of tests with a number of arsenical insecticides applied to ivy leaves are tabulated.

DOROGIN (G. N.). **Экспертиза семян на Северной Областной Станции Защиты Растений от Вредителей за 1920–27 годы.** [Seed testing at the Plant Protection Station of the North Region during the period from 1920 to 1927.]—*Plant Protec-*

tion (formerly *La Défense des Plantes*), Leningrad, vi, 1–2, pp. 173–185, 1929.

This is a brief survey, written on the occasion of the tenth anniversary of the foundation of the Leningrad Plant Protection Station, of the seed testing work which has been carried out at the Station from its inception in 1920 to the end of 1927 [cf. *R.A.M.*, v, p. 313]. A vivid description is given of the difficulties the staff had to contend with from the beginning, owing to the general conditions obtaining and to the dearth of adequate material and personnel. It has been possible, however, to rouse the interest of the local growers and regional agricultural authorities, and to convince them of the necessity for a close phytopathological examination of their seeds before sowing, as a great proportion is badly infected with various parasitic organisms, which cause heavy annual losses. In 1927, in particular, the demands on the Station in this respect have been considerable, nearly 3,000 inquiries having been dealt with. A brief description is also given of the methods developed at the Station for the rapid diagnosis of the principal fungal and bacterial parasites of various seeds, and in an appendix are reproduced the forms that have to be filled in when making an application for the testing of seed, and of the records entered in the Station books, together with instructions for the use of the testing personnel.

Budrina (Mme A. P.). **Пять лет фитопатологической экспертизы семян.** [Five years' work in the phytopathological testing of seeds.]—*Plant Protection* (formerly *La Défense des Plantes*), Leningrad, vi, 1–2, pp. 187–204, 6 graphs, 1929.

After a brief description of the methods used at the Leningrad Plant Protection Station [see preceding abstract] for the phytopathological survey of various crop seeds (which are considered under the following headings: cereals, fodder grasses and clovers, peas and beans, flax, and vegetable garden seeds), the author gives a number of concrete examples of the results obtained by the Station during the period from 1922 to 1927. The incidence and severity of infection of the seeds with various fungal and bacterial parasites is discussed year by year, the great majority of the parasitic organisms identified being well known. Of interest, however, is the fact that in 1924 the whole of the peasant-grown rye seed-grain was found to be heavily contaminated with spores of *Ustilago bromivora*.

In stressing the importance of the work done in this respect by the Station, the author states that it would be still greater if the practice of sending samples of seeds for phytopathological examination after the harvest became generalized, as it would then be possible to determine infection foci which serve to transmit the diseases from one year to the next.

Blochwitz (A.). **Schimmelpilze als Pflanzenparasiten.** [Moulds as plant parasites.]—*Ber. Deutsch. Bot. Gesellsch.*, xlvii, 6, pp. 351–356, 1929.

In connexion with his studies on the infection of *Drosophila* by moulds [*R.A.M.*, viii, p. 379], the writer carried out an experiment

to ascertain whether certain species of *Aspergillus* and *Penicillium* would attack *Mucor* and *Rhizopus* in mixed cultures on pear peelings at 30° C. It was found that the sparsely-growing strains of *A. flavus*, *A. fumigatus* and the closely allied *A. malignus*, *A. niveus* n. sp., *A. galeritus* n. sp. [ibid., viii, p. 675], *A. nidulans*, and *Penicillium glaucum* were parasitic on *Mucor* and *Rhizopus*, but not *A. wentii*, *A. purpureus*, or *A. flavus* [var.] *major*. Thus, the species parasitic on *Mucor* and *Rhizopus* were the same (with the exception of *P. glaucum*) as those attacking *Drosophila*.

None of the above-mentioned species was found capable of attacking healthy pears, apples, or cherries. The author reviews at some length the observations that have been made regarding the capacity of species of *Penicillium* and *Aspergillus* to attack various fruits and considers that further investigations are necessary to reconcile the apparently discrepant results that have been reported.

McKinley (E. B.). **Filterable virus and Rickettsia diseases.**—*Philipp. Journ. of Sci.*, xxxix, 1–4, pp. 1–416, 70 pl., 1 fig., 6 graphs, 1929.

Over sixty diseases affecting man, animals (including fowls, fishes, and insects), and plants are said to be known or believed to be caused by ultramicroscopic or filterable viruses. The present work is intended to provide a comprehensive survey of the available data in regard to these diseases [though the section on plant viruses is brief and of relatively minor importance], and further, to stimulate progress in their investigation [*R.A.M.*, viii, p. 661]. The virus diseases, on the basis of present knowledge, may be divided into four general groups, viz., (1) those known to be caused by filterable viruses; (2) those thought to be due to this cause in the absence of any demonstrable etiological agent; (3) those referred to bacterial or protozoal agents the actual status of which has not been definitely determined; and (4) those attributed to Rickettsiae, the ultimate classification of which is still uncertain. Each section of the work is supplemented by bibliographical references, while some of the more important researches on the various aspects of the virus diseases are summarized and discussed.

Hocquette (M.). **L'évolution des bactéries parasites de certains tubercules radiculaires d'Alnus glutinosa.** [The evolution of the bacteria parasitic on certain root tubercules of *Alnus glutinosa*.]—*Comptes rendus Soc. de Biol.*, ci, 22, pp. 698–699, 1929.

The bacteria penetrating the root tubercles of alder (*Alnus glutinosa*) in France by means of mucous pseudo-hyphae [*R.A.M.*, viii, p. 615] are rod-shaped and measure 1 to 2·5 by 0·2 to 0·4 μ. They appear to be immersed in a dense zoogloeal mucus, progressively increasing in volume until the cellular cavity is almost completely filled. At this stage the bacteria gradually break down into a homogeneous, amber-coloured globule. This mode of evolution is comparable to that occurring in the *Rhizobium* of the root nodules of the Leguminosae [*R. leguminosarum*], to which the alder bacteria should probably be referred.

BEAUVERIE (J.). **Un nouvel aspect de la question de l'immunité chez les plantes. La production d'anticorps de la nature des précipitines.** [A new aspect of the question of immunity in plants. The production of antibodies of the nature of precipitins.]—*Rev. de Bot. Appliquée*, ix, 93, pp. 293–298; 94, pp. 371–377, 1929.

After briefly reviewing the history of investigations into the question of acquired immunity in plants, with special reference to the work of Nobécourt [*R.A.M.*, vii, p. 338], the author gives a detailed account in popular terms of Kostoff's researches into the production of antibodies by grafting between certain species and genera of the Solanaceae [ibid., viii, p. 327].

DOBROZRAKOVA (Mme T. L.). **К вопросу о взаимоотношениях между растением и грибом.** [On the question of the interrelationship between plant and fungus.]—*Morbi Plantarum*, Leningrad, xviii, 1–2, pp. 30–44, 1929. [German summary.]

The investigation briefly outlined in this paper was intended to determine the effect of biological factors, such as age and physiological condition of the host, as well as of environmental conditions, on the susceptibility of plants to infection by parasitic fungi and facultative parasites. *Plasmopara nivea* on *Aegopodium podagraria*, *Peronospora ficariae* on *Ranunculus ficaria*, and *Bremia lactucae* on *Sonchus asper*, represented the true parasites; while *Alternaria brassicae* on cabbage, and six species of *Fusarium*, namely, *F. avenaceum*, *F. graminearum* [*Gibberella saubinetii*], *F. falcatum*, *F. solani* f. *minus*, *F. nivale* [*Calonectria graminicola*], and *F.* sp., stated to have been identified as the usual cause of winter injury to cereals in Russia [see above, p. 771], represented the facultative parasites.

The results indicated the absence of any inter-dependence between the age of the plant and its susceptibility to infection by the parasitic group; in some cases the physiological condition of the host appeared to have some bearing on its susceptibility, in the sense that the incubation period was affected. In the case of the facultative parasites, the biological factors, and more especially the condition of the host in respect of its general health, were shown to play an important part in the susceptibility of the plants to infection.

The results of experiments, in which the inoculated plants were exposed to different temperatures (from 3° to 25° R.) showed that in the case of the Peronosporaceae the effect of the lower temperatures was only a lengthening of the incubation period; in the species of *Fusarium* tested, however, there was also an appreciable increase in the percentage and intensity of infection at the lower temperatures. The external factor which appeared to exert the greatest action on the susceptibility of the plants was the relative humidity of the air for the downy mildews and that of the soil for the species of *Fusarium*. The last-named showed some differences in their requirements in this respect; some, e.g., *G. saubinetii*, developed well under conditions of low humidity, while others, such as *C. graminicola* and *F. avenaceum*, require high humidity and thrive best in saturated soil.

MANTEIFEL (A. Y.) & SHAPOSHNIKOFF (V. N.). **Conditions of coremia formation by certain fungi.**—*Trans. Sci. Chem.-Pharm. Inst.*, Moscow, 18, pp. 31–47, 1927. [Abs. in *Chem. Abstracts*, xxiii, 15, pp. 3728–3729, 1929.]

Penicillium arenarium n. sp., *P. luteum*, *P. expansum*, and *Botrytis* [*Beauveria*] *bassiana* responded differently to the action of media in respect of coremial formation [*R.A.M.*, iv, p. 561]. *P. arenarium* produces coremia when the nitrogen content of the substratum is increased, whereas the other two species of *Penicillium* do not react to an increase of nitrogen and the development of coremia by them could be traced to the split products in the media arising from the metabolism of the first crop of fungi. The capacity of *B. bassiana* for coremial formation depends on the moisture conditions to which the cultures are exposed.

PITTMAN (H. A.). **Potato diseases in Western Australia.**—*Journ. Dept. Agric. Western Australia*, vi, 2, pp. 246–256, 5 figs., 1929.

The following potato diseases have been recorded in Western Australia: *Rhizoctonia* scab (*Corticium solani*), common scab (*Actinomyces scabies*), silver scurf (*Spondylocladium atrovirens*), wilt (*Fusarium oxysporum*), early blight (*Macrosporium* [*Alternaria*] *solani*), bacterial wilt (*Bacillus* [*Bacterium*] *solanacearum*), Irish blight (*Phytophthora infestans*), blackleg (*Bacillus atrosepticus*) [*B. phytophthorus*], mosaic, leaf roll, streak, hollow heart, and fleck (internal brown spot or sprain). A detailed account is given in popular terms of the symptoms, causes, and control of the first two diseases listed above.

SMITH (K. M.). **Studies on Potato virus diseases. V. Insect transmission of Potato leaf-roll.**—*Ann. of Appl. Biol.*, xvi, 2, pp. 209–229, 3 pl., 1929.

Inoculation experiments conducted at Cambridge in 1927 in the transmission of potato leaf roll with seven different species of insects gave negative results except with the aphid *Myzus persicae*, which gave numerous positive infections [*R.A.M.*, vii, p. 661], further tests in 1928 proving this insect to be an efficient carrier of the leaf roll virus. Tests of the inheritance of the virus by the progeny of infective aphids gave negative results. The incidence of infection was greater among plants colonized with 12 or 18 aphids than among those with only 2 or 6 (possibly because the insects tend to wander away), but two insects produced quite as severe disease as 18. Feeding upon a non-susceptible host plant for periods varying from 24 hours to 7 days had no effect upon the infective power of the aphids; it seems to be probable that *M. persicae* when once infected remains so for the rest of its life.

When the aphids were colonized upon potatoes affected with a combination either of leaf roll and streak or leaf roll and mosaic they transmitted only leaf roll to healthy potatoes but in the case of the latter combination they infected tobacco with a mottling disease identical with that caused when potato mosaic is transmitted by *M. persicae* to tobacco, indicating that they pick up

both viruses, the separation of which depends mostly upon the plant.

The incubation period of the leaf roll virus in the plant averaged about 30 days under greenhouse conditions, though occasionally the disease developed in 18 to 20 days. In Arran Victory potatoes the first symptoms are a general pallor of the youngest leaves followed by a rolling starting from the base and usually accompanied by a well-marked brownish-black pigmentation. Under glasshouse conditions this primary leaf roll rapidly passes to the secondary form, in which the lower leaves show a marked interveinal pallor followed by rolling.

Seven [named] varieties of potato were infected with leaf roll by means of *M. persicae*, no difference in the degree of resistance being noted. It was also ascertained that the aphid can disseminate the disease by feeding on the sprouts of the tuber, the haulm, or the stem itself.

HADFIELD (J. W.) & CLARIDGE (J. H.). **Certification of seed Potatoes. Review of operations, season 1928–29.**—*New Zealand Journ. of Agric.*, xxxviii, 6, pp. 367–376, 5 figs., 1929.

In this account of the work of the seed potato certification service in South Island, New Zealand [cf. *R.A.M.*, vii, p. 801], during 1928–9, the author states that unproductive cropping was mainly due to leaf roll, mosaic, stipple-streak, and crinkle. The first-named was the most serious and was commonest on Auckland Short-tip, Dakota, Up-to-Date, Majestic, and Iron Duke. Mosaic was of less importance except on Arran Chief. In two years not one Iron Duke tuber was found free from mosaic, but leaf roll was the primary cause of the many failures in this variety, which tolerates the former disease but succumbs rapidly to the latter.

HORNY (H.). **Mustergültiger genossenschaftlicher Saatkartoffelabsatz in Holland.** [Standard co-operative sale of seed Potatoes in Holland.]—*Mitt. Deutsch. Landw.-Gesellsch.*, xliv, 15, pp. 345–347, 6 figs., 1929.

The production of seed potatoes forms the staple industry of the (Dutch) Friesian Co-operative Sale Association for Seed and Plant Material [cf. *R.A.M.*, viii, p. 57]. The potato fields are located exclusively on clay soil, which constitutes somewhat over a third of the area of the whole province. The annual revenue from the sale of seed potatoes in Friesland is estimated at M. 1,750,000, and during the autumn of 1928 (1st September to 31st December), the Association disposed of over 200,000 cwt. to various European countries and Africa. Since the recent introduction of the co-operative movement into Italy, that country has become the third of the principal purchasers of Dutch seed potatoes, Germany and Belgium being the two leading importers.

The selected material of 800 co-operative growers is delivered at special centres at Leeuwarden, whence it is distributed. Most of the crop consists of the 70-year-old Eigenheimer variety, followed by Erstling [Duke of York] and Ideal (early), and Industrie, Roode Star, and Alpha (late). The success of the Friesian co-

operative movement is considered to be largely due to the exclusive use of these tested varieties.

The work of certification is conducted by 15 technical experts, and only stock that has been certified as a result of field inspection is admitted to tuber inspection. Before planting all tubers are immersed for $1\frac{1}{2}$ hours in 1 per cent. corrosive sublimate against *Rhizoctonia* [*Corticium solani*]. The cultivation of any variety which fails to show a high degree of productivity and resistance to diseases (including immunity from wart disease [*Synchytrium endobioticum*]) after three years' trial must be discontinued by members of the Society.

KŘIŽ (K.). **Dnešní stav výskytu rakoviny Bramborů v Českoslov. Republice.** [The present occurrence of the Potato wart disease in the Czecho-Slovakian Republic.]—*Ochrana Rostlin*, ix, 2, pp. 32–33, 1929.

Continuing his yearly reports on the occurrence of potato wart disease [*Synchytrium endobioticum*] in Czecho-Slovakia [*R.A.M.*, vii, p. 534], the author states that in 1927 a new infection centre was recorded only in one locality of the Upper Laba. This fact indicates the efficacy of the control measures imposed in 1925, the chief of which is the obligatory use of wart-resistant varieties in all infected districts. Among such varieties very favourable results, both from the point of view of disease resistance and cropping qualities, have been given by Prussian, Hindenburg, Jubel, Červencová Perla, and certain English varieties [not specified].

SALUNSKAYA (Mme N.). Заметка о консервировании клубней больного Картофеля по способу Н. А. Рождественского. [Note on the preservation of diseased Potato tubers by N. A. Rojdestvensky's method.]—*Morbi Plantarum*, Leningrad, xviii, 1–2, p. 65, 1929.

Fairly good specimens of potato tuber skin are obtained for permanent preservation by the following method: a thin surface layer is cut from a large tuber which must be as flat as possible; the section is kept overnight, and next day it will be possible to cut out most of the flesh, as the section will have lost its turgor and may be spread out on a board or a glass cover. The rind is then boiled until the remaining flesh softens and may be easily scooped off with a spoon or the blunt side of a knife; the resulting skin is then transparent, but care should be taken not to boil the section too long, as then the skin breaks up. After boiling, the skin is cleared for a minute or two in lactic acid (the usual solution diluted with 2 or 3 volumes of water). The skin is then dipped in boiling water, and is pasted on gelatine paper while it is still hot.

In order to preserve the light colouring of potato flesh sections, the sections should be placed, immediately after boiling, for less than a minute in the same lactic acid solution as above; if kept too long in the solution, the sections may assume a brownish-red tint. On removal from the solution, the sections are dipped in boiling water and pasted on gelatine paper.

POOLE (R. F.) & WOODSIDE (J. W.). **A chemical control for Sweet Potato wilt or stem rot.**—*North Carolina Agric. Exper. Stat. Tech. Bull.* 35, 18 pp., 1929. [Abs. in *Chem. Abstracts*, xxiii, 15, pp. 3769–3770, 1929.]

Good control of sweet potato wilt or stem rot (*Fusarium batatatis*) [*R.A.M.*, viii, p. 59] has been obtained by dipping the roots in Bordeaux mixture. Satisfactory results were given by a 20-20-25 Bordeaux mixture and a 25 per cent. monohydrated copper sulphate-lime dust.

TAYLOR (R. A.). **A note on brown bast.**—*Trop. Agriculturist*, lxxii, 6, pp. 323–336, 1928.

After briefly reviewing the various theories hitherto advanced to explain the origin of the brown bast disease of *Hevea* rubber, the author gives a few details of experiments which were conducted since 1923 in Ceylon [a preliminary report on which was published in a previous paper: *R.A.M.*, v, p. 581] to test their validity. The results obtained indicate that neither the amount of latex extracted from the trees, nor the depth to which the tappings are made, are factors in increasing the percentage of trees affected with the disease; in one lot of 30 trees which were tapped to the normal depth on one side and down to the wood on the other, all the normal cuts but two showed symptoms of brown bast, while of the deeper cuts only three showed definite symptoms. At the same time, it is well known that an increase in the yield of latex is obtained by slightly increasing the thickness of the shavings removed when tapping. It is believed that the reason why the full potential yield of a cut is not obtained when excessively thin shavings are removed is that all the plugs of coagulated latex which form in the ends of the cut vessels are not removed by this operation, since it is to be expected that the plugs in the narrower vessels may be cut through or left inside the vessels, while those in the wider vessels would be pulled out. All these facts taken in conjunction lead the author to suggest a new theory of the mechanism of brown bast, which is summarized by him as follows: brown bast is the disorganization of cells (latex cells, sieve-tubes, and probably other cortical cells) caused by the frequent sudden changes of pressure due to the release of pressure during tapping from some latex cells and the non-release from others. Meristematic activity is secondary and probably can be regarded as a wound effect or a natural enclosing of a foreign or a dead particle, in this case the dead cell, in a special tissue so that it is isolated from the surrounding living tissue. It is argued that while the diameter of a latex vessel may vary considerably throughout its length, this variation is much less than that found between different vessels in the same section, so that a vessel which is classed as narrow at one point will never be very wide. It may therefore be assumed that, at least during a few consecutive months' tapping, the same vessels will often remain plugged. The release of pressure in one vessel, while the pressure in its neighbours is maintained, must allow the latter to expand until the tension is again equal. The 'unreleased' latex cell, therefore, absorbs water from the surrounding cells and expands until an osmotic equilibrium is

again attained. During this process the surrounding cells suffer, as well as, in all probability, the latex vessel in which the pressure was released. It is suggested that this frequent withdrawal of excessive amounts of water from the surrounding cells produces such a condition that coagulation of their protein contents takes place and is followed by the loss of functional activity and death. The affected cell will then become the centre of meristematic activity and probably later the core of a nodule.

In regard to prevention and treatment, the balance of evidence tends to show that it is unlikely that any tapping system can be evolved which will ensure complete immunity from brown bast. In the drier districts, especially, it is thought that daily tapping in alternate months or some similar system would be preferable to regular alternate day tapping, since there is less time for drying back of the bark between tappings, and the plugs formed in the opened ends of the vessels have less chance of remaining. It is also suggested that there is an optimum limit to the thinness of shaving removed by the tapper. Another useful measure might be an isolation cut (a single cut, not a channel) made down to the wood and running down either side of the pannel; this would put a barrier between the two pannels on a tree, as the cut immediately fills up with latex and in a short time a barrier of rubber is formed which to all intents and purposes is impenetrable; this measure would also ensure that at least at the ends of the cut no released vessel is situated next to an unopened vessel.

ZIMMERMANN (A.). **Die Rindenbräune von Hevea.** [Brown bast of *Hevea*].—*Tropenpflanzer*, xxxii, 8, pp. 335–341, 1929.

The main burden of this paper is a criticism, on physiological grounds, of the new theory suggested by Taylor [see preceding abstract] of the origin of the brown bast disease of *Hevea* rubber. The chief point made is that there can hardly exist any considerable differences in pressure between the narrow 'unreleased' vessels and the wider 'released' vessels, since the latex system is joined together into a whole by frequent lateral communications from one vessel to another, so that any difference in pressure at one point is rapidly evened out so long as a few vessels in a bundle are opened, and osmotic equilibrium is rapidly restored throughout the network.

CHEAL (W. F.). **Investigations of Hop mosaic disease in the field.**—*Ann. of Appl. Biol.*, xvi, 2, pp. 230–235, 2 figs., 1929.

Observations made from 1923 to 1925 in a number of Kentish hop gardens on mosaic disease [*R.A.M.*, viii, p. 60] indicated that in general the condition spreads from areas occupied by diseased plants, and that it may be introduced by outwardly unaffected carriers.

No signs of mosaic were observed until the plants were 3 to 4½ ft. high. As a rule the first indication of the disease was noted in the leaves at the tip of the plant, from 5 to 7 days sufficing for an apparently normal plant to develop definite symptoms of severe mosaic.

Reference is made to a special type of mottling which appears

two or three weeks before picking, generally on not more than three short laterals at the head of an otherwise healthy plant. When these laterals bear hops the cones are deformed and undersized, while some of the mottled laterals die back at the tips. Counts made during this period indicated that two-thirds of the plants showing mottling in any one year develop ordinary mosaic symptoms the next; the remainder may be normal in the second and third years, or in a very few instances may show mosaic in the third year. In numerous cases severe mosaic was noted in 1924 on plants which had appeared quite healthy the year before. During conditions favouring rapid growth mosaic plants may apparently remain unaffected, but this no longer holds when the conditions cease. No cases of permanent recovery were observed, and no correlation could be established between applications of fertilizers and the incidence of the disease.

Prompt grubbing carried out over a period of two years will check the spread of mosaic and in some cases may reduce the amount present in the third year.

When roguing is decided on the plants should be examined at least twice, when they are about 4 to 6 ft. high and again two or three weeks before picking. Sets should not be taken from infected gardens, and the filling up of gaps with cuttings from neighbouring hills should be avoided.

BELL (A. F.). **The distribution of Sugar-Cane diseases.**—*Ref. Book Sugar Indus. of the World*, vii, pp. 31–32, 1929.

During the period 1924 to 1928 the writer visited a large number of the sugar-producing centres of the world, and in this paper he gives a brief account of the distribution of the principal diseases of sugar-cane [*R.A.M.*, viii, p. 463], together with notes on actual and prospective measures for their control.

Seven diseases are classified as of major importance, viz., gumming [*Bacterium vascularum*], leaf scald [*Bact. albilineans*: ibid., viii, p. 669], downy mildew [or leaf stripe: *Sclerospora sacchari*], mosaic, streak [ibid., viii, p. 403], red rot [*Colletotrichum falcatum*], and Fiji disease. The position of sereh disease is regarded as problematical. It was a scourge in Java during the latter part of the last century but is now stated to be declining in severity [ibid., viii, p. 667]; moreover, it appears to develop only under the very special conditions prevailing in Java.

Generally speaking, these diseases seem to be most prevalent in the countries bordering on, or included in, the East Indian Archipelago, while three, namely, Fiji disease, leaf scald, and downy mildew are confined to that part of the world, and probably originated in New Guinea. Streak is restricted to the cane countries bordering on the Indian Ocean, viz., South Africa, Mauritius, India, and Egypt. Gumming disease was reported from Brazil in 1860 and was probably conveyed with a shipment of Brazilian canes to Mauritius in 1869 and thence to Australia in 1880 to 1890; it is thus the only major disease originating in the Western Hemisphere.

The distribution of the seven major diseases is also shown in the form of a list.

FARIS (J. A.). **Field control of Sugar-Cane mosaic in Cuba.**—*Ref. Book Sugar Indus. of the World*, vii, pp. 32–35, 1 map, 1 graph, 1929.

The results [which are tabulated and shown by means of a diagrammatic map] of two field surveys conducted in 1924–5 and 1928–9 to determine the present situation of sugar-cane mosaic in Cuba [*R.A.M.*, viii, p. 403] reveal a very definite localization of areas of rapid and slow spread of the disease. A gradual reduction in the incidence of mosaic is taking place throughout the zones of low and medium spread by the use of selected seed of the resistant P.O.J. 2714, 2725, and 2727 varieties, but owing to the constant increase of infection in the ratoons, little progress in this direction has been made in the areas of highest spread.

A marked correlation was observed between certain soil types and the high or low rate of spread of mosaic. For instance, the Matanzas red clays and the Perico, Alto Cedro, and Yaguajay clays are all areas of relatively slow spread, while rapid progress is made on alluvial river bottom and sandstone or interbedded sandstone and limestone soils, and the grey or black limestone hill and serpentine soils are intermediate in this respect.

Mosaic was shown by experiments to spread much more rapidly during the first months of growth in the spring-planted cane than during the corresponding period in the autumn plantings owing to the heavy rainfall at the former time. The most rapid spread (up to 47·8 per cent. in a fortnight) occurred from 2nd July to 15th August, when the cane was $2\frac{1}{2}$ to 4 months old; the highest extension in the autumn plantings was 13·7 per cent. in a fortnight.

In connexion with a brief résumé of the comparative susceptibility to mosaic of the sugar-cane varieties commonly cultivated in Cuba [ibid., viii, p. 667], it is pointed out that, notwithstanding the alleged tolerance of P.O.J. 36, there is a very appreciable tonnage loss when diseased seed of this variety is used; consequently the extension of the areas under this variety in zones of high mosaic spread tends to complicate the problem of control.

LOBIK (A. I.). Материалы к микологической флоре Терского округа. [Materials for the mycological flora of the Terek district.]—*Morbi Plantarum*, Leningrad, xvii, 3–4, pp. 157–199, 9 pl., 1928. [German summary. Received August, 1929.]

Continuing his systematic study of the fungi of the Terek district [north Caucasus: *R.A.M.*, vii, p. 809], the author gives descriptions in German of 104 species and varieties, considered to be new. The following are amongst those of phytopathological interest.

Pleosphaerulina setariae forms, on leaves of *Setaria viridis*, yellowish-brown, diffuse spots, with a whitish centre. The perithecia are epiphyllous, immersed, light brown, and 132 to 164 μ in diameter. The asci are hyaline, and 69·4 to 78·7 by 26·3 to 39·5 μ. The spores are hyaline, rounded at the base and somewhat tapering at the apex, slightly constricted in the middle, with 4 or 5 transverse septa and a longitudinal septum in one or two of the median

cells, and 29·6 to 32·9 by 11·4 to 13·2 μ in diameter. *Mycosphaerella althaeina* forms, on leaves of hollyhocks (*Althaea rosea*), rounded or irregular, greyish or whitish spots with a narrow, light brown margin. The perithecia are epiphyllous, immersed, black, and 86·4 to 100 μ in diameter. The asci are obclavate, and 36·2 to 42·8 by 8·2 to 9·9 μ. The spores are hyaline, rounded at the base, two-celled, somewhat constricted at the septum, and 11·5 to 13·2 by 4·9 μ. *Sclerophoma capsici* forms grey spots of varying sizes bearing dark brown, immersed pycnidia with sclerotial walls, and also numerous sclerotia measuring 129 to 230 by 129 to 157 μ, on fruits of chilli pepper (*Capsicum* [*annuum* var.] *longum*. The spores, embedded in a jelly-like mass, are continuous, long-clavate, ovoid, or almost cylindrical, hyaline, and vary greatly in size, ranging from 8·2 to 16·6 by 2·6 to 3 μ. Similar pycnidia develop freely on the seed of infected fruits. *Hendersonia triticina* forms, on leaves and leaf-sheaths of wheat, dispersed, immersed, light brown pycnidia, 113 to 181 μ in diameter. The spores are smoky green (in mass light brown), straight, cylindrical, tapering at both ends, or straight on one side and somewhat convex on the other, or else spindle-shaped, with 3 to 7 (occasionally 8) septa; 4-celled spores measure from 16·5 to 23 by 3·3 μ, and the 8-celled from 25·2 to 33·6 by 3·3 to 4·2 μ. The large number of new species of *Septoria* described on grasses and other plants include the following. *S. fragariaecola* forms, on the leaves of strawberry (*Fragaria vesca*), irregular, light brown, yellowish-green or dark greyish-brown spots, delimited by the veins or with indistinct margins, bearing on both sides large, immersed, light brown pycnidia, 231 to 273 μ in diameter. The spores are straight or slightly curved, slightly tapering at the apex, hyaline, with 1 (rarely 2 or 3) septa, and measure 25·6 to 84 by 2·6 μ. *S. melongenae* forms, on eggplant leaves, greyish or greyish-brown, rounded spots, 0·2 cm. in diameter, surrounded by a thick ring. The pycnidia are immersed, brown, and measure 121 to 198 μ. The spores are filiform, variously curved, with 7 or 8 septa, and measure 39·5 to 72·4 by 1·6 to 2·3 μ. *S. triticicola* forms pale longitudinal spots on wheat leaves. The pycnidia are epiphyllous, immersed, light brown, and 105 to 168 μ in diameter. The spores are hyaline or faintly green, slightly curved, with rounded ends, 3- to 5-septate, and 26·3 to 48 by 3·3 to 3·9 μ. *S. triticina* produces on the lower, dry leaves of wheat (*Triticum vulgare* var. *milturum*) light brown, immersed pycnidia, singly or in groups and 82 to 197 μ in diameter. The spores are hyaline, slightly curved, rounded at the base and tapering towards the apex, 2- to 6-septate, and measure 36·2 to 55·9 by 3·3 to 3·6 μ. *Colletotrichum melongenae* forms, on eggplant fruits, greyish-brown, oval, zonate spots, up to 8 by 5 cm. in diameter, extending over much of the fruit. The acervuli are more densely grouped towards the margins, and are from 115 to 198 μ in diameter. Setae occur marginally and centrally; they are greyish-brown, 1- to 3-septate, tapering towards the apex, and 49·4 to 108 by 4·9 to 6·6 μ. The conidiophores are straight, greyish-brown, and 21 to 29·4 by 3·3 to 4·2 μ. The spores are long-ovate or clavate, hyaline, straight or slightly curved, and 18·9 to 25·2 by 4·2 to 4·6 μ. *Napicladium iridis* forms, on leaves of *Iris germanica*,

light brown, rounded or oval, zonate spots with a diffuse, brown, broad margin. The conidiophores are in small black tufts; they are straight or slightly bent towards the apex, with or without a bulbous swelling at the base, olive-brown, continuous or with 1 to 3 septa, and 62·5 to 85·5 by 9·9 to 14·8 μ; the basal swelling is 14·8 to 18 μ in diameter. The spores are faintly smoky or brownish, 1- to 3-septate, slightly constricted at the septa, broadly rounded at the base and almost conically tapering at the apex, and measure 26·3 to 49·4 by 16·5 μ. *Cercospora amaranthi* forms, on leaves of *Amaranthus retroflexus*, brown, indistinctly zonate, rounded, dispersed or coalescing amphigenous spots, covered with a thin, greyish efflorescence of olive-brown, short, continuous, straight or slightly geniculate conidiophores, 32·9 to 105 by 4 to 5 μ. The spores are hyaline, straight, tapering towards the apex and truncate at the base, up to 8-septate, and 60 to 120 by 3·5 μ, diminishing to 2 μ at the apex.

The great majority of the new species described are illustrated.

CIFERRI (R.). **Micoflora Domingensis. Lista de los hongos hasta la fecha indicados en Santo Domingo.** [Dominican mycoflora. List of fungi recorded up to the present in San Domingo.]—*Estác. Agron. de Moca*, Ser. B-Botán., 14, 261 pp., 1 map, 1929.

This survey of the fungi hitherto recorded in the Dominican Republic (comprising 868 species, of which 200 or 23 per cent. are endemic) is based largely on the series compiled by the author in collaboration with González Fragoso during the period 1925–28 [*R.A.M.*, viii, p. 200]. A 16-page bibliography, a key showing the classification of the fungi listed, and a host index are included in the work.

DA CAMARA (E. DE S.). **Mycetes aliquot novi aliique in mycoflora Lusitaniae ignoti.** [Some new fungi and others unknown in the mycoflora of Portugal.]—Reprinted from *Rev. Agron.*, xvii, 2, 11 pp., 5 pl., 1929.

The following records are of interest in this list of 12 fungi new to science or to the mycoflora of Portugal, all discovered in the spring and early summer of 1929. The chestnut blight fungus *Endothia parasitica* [*R.A.M.*, viii, p. 535] is stated to have been found on the branches and trunks of *Castanea crenata* at Alcaide (Beira Baixa). Only the pycnidial stage has been observed. The spores are 'isodiametric', generally more or less allantoid, and measure 4·5 to 5 by 1 to 1·5 μ.

Physalospora cinnamomi n. sp., found on the branches of *Cinnamomum zeylanicum* in Lisbon, is characterized by subglobose, papillate, black perithecia up to 270 μ in diameter; claviform, hyaline asci, 70 to 90 by 19 to 26 μ, with filiform paraphyses, and containing eight subdistichous, ovoid or elliptical, straight, hyaline ascospores, rounded at both ends and measuring 18 to 29 by 11 to 13·5 μ.

Massarina almeidana n. sp., on the leaves of *Phormium tenax* in Lisbon, possesses more or less ellipsoid, black, papillate perithecia up to 250 μ in diameter; oblong-cylindrical, hyaline asci, measuring

90 to 100 by 16 to 18 μ and containing eight monostichous or subdistichous, fusiform, four-septate, straight, hyaline ascospores, rounded at both ends and measuring 23 to 26 by 6·5 to 8 μ. The spores are unequally divided by a constriction into an upper 1-septate and a lower 2-septate part.

Microdiplodia phormii, found in conjunction with the foregoing, is characterized by subglobose or piriform, black pycnidia, up to 250 μ in diameter, occupying large, sinuous, yellowish-grey, chestnut-bordered spots; ellipsoid, sometimes elliptical-ovoid, occasionally oval, sulphur- to chestnut-coloured spores, truncate or less often subrotund at both ends, usually uni-, sometimes bi-septate, and measuring 11 to 15 by 4·5 to 6·5 μ.

Graphium necator, the conidial stage of *Rosellinia necatrix* [ibid., viii, p. 288], was found on the bark of *Castanea vesca* trunks at Alcaide.

NAGORNY (P. I.). **Кавказские виды рода Urocystis Rabenhorst.** [Caucasian species of the genus *Urocystis* Rabenhorst.]—*Scientific Papers Applied Sections of Tiflis Bot. Gard. 1929*, 6, pp. 104–108, 1929. [German summary.]

Of the five species of *Urocystis* that have so far been recorded in the Caucasus, and brief descriptions of which are given in this paper, the following occur on plants of economic importance: *U. cepulae* on onion and leek; *U. occulta* on rye; and *U. violae* on cultivated violets. The morphological characters of the spores of all the five species are given in a comparative table.

WEBER (G. F.). **The occurrence of tuckahoes and Poria cocos in Florida.**—*Mycologia*, xxi, 3, pp. 113–130, 1 pl., 5 figs., 1929.

After reviewing the history and geographical distribution of tuckahoes (*Poria cocos*) [*R.A.M.*, iii, p. 376] the author states that the sclerotia of the fungus have recently been found on sandy soils in various parts of Florida. From published accounts it appears that they were roasted and eaten by the southern negroes, who learned of their use from the Indians; they were also made into a sort of bread, but according to one writer were thought to be poisonous if taken raw. They were considered to possess medicinal properties, but Murrill stated that there was no foundation for this.

They have been recorded on the roots of sumac [*Rhus* spp.], various conifers, oaks, eucalyptus, maize, citrus, and *Magnolia grandiflora*.

A full description of these sclerotia is given, and it is stated that in Florida the small ones resemble the bark of trees, the cortex being striated and ridged from edge to edge. The cortex is 3 to 8 mm. in thickness, and is often wrinkled and crevassed, furrowed or grooved; sometimes the surface is roughened, especially in the large ones, though small specimens are often smooth or warty. The perfect stage was developed by the author [by methods which are indicated] in pure culture.

The various common and scientific names applied to the sclerotium of *P. cocos* since 1722 are listed. The term tuckahoe, formerly

used for all tuberous terrestrial growths, is suggested for the bulbous rootstalks of phanerogamic plants only; the fungous tubers should be grouped under the term sclerotia when their fruiting structure is unknown, and classified according to the fructifications they produce when fertile.

Weathered and partially disintegrated fruiting structures similar to those artificially produced were observed in nature on the cortex of several sclerotia.

A bibliography of 47 titles is appended.

NAGORNY (P. I.) & ERISTAVI (E. M.). **Грибы, собранные на Чайном кусте на Чаквинских плантациях в 1927 году.** [Fungi collected on the Tea bush on the Tschakva plantations in 1927.] —*Scientific Papers Applied Sections of Tiflis Bot. Gard. 1929*, 6, pp. 109–112, 1929. [German summary.]

Brief descriptions are given of the following parasitic fungi which were collected in 1927 on tea in the plantations at Tschakva, near Batum [Black Sea littoral]: *Guignardia theae* [*G. camelliae*]; *Phyllosticta theae*; *Pigottia theae* Newodowsky, which forms on the leaves brownish or sometimes whitish spots with a sharply defined margin of a darker colour; the pseudopycnidia occur in groups, and may cover the whole surface of the spots on both sides of the leaves; the conidiophores are short and densely crowded; and the stylospores are narrow-cylindrical, continuous, straight, hyaline or faintly coloured, and measure 13 to 15 by 2 to 2·5 μ; *Discosia theae*; *Colletotrichum camelliae* [*Glomerella cingulata*]; *Pestalozzia guepini* [*P. theae*] causing the well-known grey blight; and *P. funerea*. The last-named forms large, irregular, reddish-brown spots bearing on both sides numerous protruding acervuli; the spores are five-celled and 28 by 6 to 8 μ; the median cells are dark brown and the terminal hyaline; the cilia have five small branches; this fungus also occurs on the leaves of rhododendrons and the needles and twigs of some conifers.

Modification of nursery stock, plant, and seed quarantine regulations. Amendment No. 1 of revised rules and regulations supplemental to notice of quarantine No. 37.—*U.S. Dept. of Agric., Plant Quarantine and Control Admin. Leaflet*, 1 p., 1929.

Regulation No. 3 of the revised rules and regulations supplemental to notice of quarantine No. 37 [*R.A.M.*, v, p. 320] is amended, as from 1st August, 1929, to provide that stocks of apple, pear, quince, and mazzard cherry [*Prunus cerasus*] may not be imported under any conditions after 30th June, 1930, while other fruit stocks, including mahaleb cherry [*P. mahaleb*] and myrobalan plum [*P. divaricata*], may not be imported, by permit or otherwise, after 30th June, 1931.

Legislative and administrative measures. Brazil.—*Internat. Bull. of Plant Protect.*, iii, 6, pp. 86–87, 1929.

An Ordinance, dated 26th May, 1928, of the Brazilian Ministry

of Agriculture, Industry and Commerce, prohibits the importation of coffee and coffee plants and seeds and plants of other species of Rubiaceae from any country; and potato tubers from any country, unless accompanied by a certificate of origin and health vouching that the locality of origin is free from the diseases caused by *Synchytrium endobioticum* and *Spongospora subterranea*; until further notice the importation of potato tubers from Portugal and Spain is prohibited. Sugar-cane plants and cuttings may not be imported from any country without a certificate of freedom from Fiji disease, while all species and varieties of citrus from Asia, Oceania, South Africa, and the United States must be accompanied by a statement that the place of origin is free from *Pseudomonas citri*.

Barbados. 1929-22. An Act to amend the Mosaic Disease (Eradication) Act 1927, (1927-23), the Mosaic Disease (Eradication) Amendment Act, 1927, (1927-27), and the Mosaic Disease (Eradication) Amendment Act, 1927 No. 2, (1927-38).—2 pp., 1929.

The Mosaic Disease (Eradication) Amendment Act 1929, taking effect from 16th May, 1929, introduces certain amendments into the Principal Act and subsequent Amendment Acts [cf. *R.A.M.*, v, p. 189; viii, p. 336].

Section 4 (subsection ii) of the Amendment Act No. 2, which prohibits the planting of cuttings from fields proclaimed to be infected, is amended by the substitution of the words 'cane plants' (defined as meaning any portion of a sugar-cane which is used for planting) for 'cuttings'. Subsection iii of section 4, prohibiting the planting of canes from infected fields unless the material has previously been inspected by an officer of the Department of Agriculture and pronounced free from mosaic disease, is repealed and the following substituted: 'It shall be unlawful for any person to plant, sell, remove or otherwise distribute cane plants from a field in an area that has been proclaimed to be infected with the mosaic disease unless the canes in such field have been inspected by an officer of the Department of Agriculture, have been pronounced to be free from mosaic disease, and such person has been given the written permission of the Director of Science and Agriculture to plant, sell, remove or otherwise distribute such cane plants.' Subsections iv to vi, providing for the issue of duly authenticated certificates authorizing the planting of inspected and approved material, are amplified by the addition, to subsection vi, of a clause prohibiting the planting of a larger number of cane plants than the number stated in the certificate of approval. Subsection viii, defining the conditions governing the supply of healthy cane by the Department of Agriculture, is amended by substituting the words 'from the first day of November in any year to the thirty-first day of March in the next succeeding year' for 'the period November 1927 to May 1928'; and by substituting the words 'at the rate of threepence a hundred' for 'free of charge' in reference to the supply of healthy plants to holders of areas of land not exceeding one acre in extent.

Legislative and administrative measures. Peru.—*Internat. Bull. of Plant Protect.*, iii, 6, pp. 88–89, 1929.

The sugar-cane plantations in the Rímac and Carabayllo Valleys of Peru have been declared, by a Presidential Decree of 10th August, 1928, to be infested by mosaic disease [*R.A.M.*, viii, p. 668]. The movement of cuttings from these areas to other parts of the Republic is therefore prohibited.

DOIDGE (E[THEL] M.). **Legislative and administrative measures. Union of South Africa.**—*Internat. Bull. of Plant Protect.*, iii, 7, p. 104, 1929.

Government Notice No. 520 of 1929 makes the following provisions for the eradication of psorosis or scaly bark of citrus [*R.A.M.*, vii, p. 128]. Infected trees, after being covered with straw or other inflammable material and sprayed with paraffin, are to be burnt *in situ*, after which the stump shall be dug out at least 18 inches below the surface of the soil and as many as possible of the main roots removed and burnt.

Exemption from these provisions may be granted by the Minister of Agriculture in cases (*a*) where he is satisfied that the presence of the infected trees constitutes no danger to trees in adjacent orchards; and (*b*) where it is considered desirable that such trees should be left for purposes of experiment or observation by members of his Department.

Legislative and administrative measures. Cuba.—*Internat. Bull. of Plant Protect.*, iii, 6, p. 88, 1929.

An Ordinance dated 21st January, 1929, provides for the issue of special permits by the phytosanitary authorities for the importation into Cuba of lily [*Lilium longiflorum* var. *eximium*] bulbs from Bermuda. The bulbs must be packed without soil, sand, straw, or leaves of plants, and must be accompanied by a duly authenticated certificate of freedom from dangerous diseases and pests.

Legislative and administrative measures. Austria.—*Internat. Bull. of Plant Protect.*, iii, 6, pp. 83–86, 1929.

Particulars are given concerning the provisions of the Austrian Poison Ordinance (Giftverordnung No. 362) of 20th December, 1928, in which the following points, *inter alia*, are of interest. The liquid disinfectants, germisan, kalimat B, salvocer, urania, uspulun-universal, and weizen-fusariol, and the dusts abavit B, fusariol-trockenbeize, paragel, porzol, salvocer paste, salvocer-staubbeize, and tillantin may be delivered without commercial restrictions. The application of toxic sprays and dusts to economic and ornamental plants is permitted only at certain times and under special safeguards [which are defined]. Products destined for human consumption (including fallen fruit for jam or cider manufacture) may not be gathered until five weeks after treatment with a toxic substance [cf. *R.A.M.*, vi, p. 628].

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ERRATA

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	342	12	,,	'*Eucalytus*'	,, '*Eucalyptus*'
	395	41	insert	'McCallan (S.E.A.) &'	before 'Wilcoxon (F.)'
	440	3	for	'*guava*'	read '*guajava*'
	453	36	,,	'the West Indies'	,, 'India'
	463	28	,,	'*uniloides*'	,, '*unioloides*'
	501	48	,,	'attacked'	,, 'contaminated'
	512	19	,,	'1931'	,, '1930'
	519	45	,,	'*platinifolia*'	,, '*platanifolia*'
	551	40	,,	'*vuillemini*'	,, '*vuilleminii*'
	554	4	,,	'*Ann.*'	,, '*Anais*'
	585	14	,,	'each at the rate of'	,, 'at the total rate of'
	589	23	,,	'x, p. 1'	,, 'x, p. 17'
	615	32	,,	'3214, pp. 852–853'	,, '3210, p. 702'
	626	44	insert	'*Lisea fujikuroi*'	before 'for which'
	649	23	for	'*tritica*'	read '*tritici*'
	708	18	,,	'*Ichnaspis*'	,, '*Ischnaspis*'
	713	14	,,	'Greaney (F. G.)'	,, 'Greaney (F. J.)'
	746	48	,,	'Propfenbilding'	,, 'Pfropfenbildung
	771	42	,,	'*Altemaria*'	,, '*Alternaria*'
	798	46	,,	'*ducis* Pauli'	,, '*ducis-pauli*'
	805	4	,,	'86'	,, '89'
		7	,,	'California'	,, 'N. Carolina'